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Vol. 28 — No. 1

CONTENTS

TITLE PAGE 1

FRONTISPIECE
Dr. Harold Simmerman 2

ORIGINAL PAPERS

Accommodative-Convergence in Presbyopia.
Meredith W. Morgan, Jr. and Henry B. Peters 3

Clinical Significance of the Abduction Findings.
J. Donald Kratz 11

The Effect of Light Absorbing Filters on the Discernibility of a Television Test Pattern. Harold Stein, Henry W. Hofstetter and Robert Graham 19

Changes in Visual Skills of School Children Following Summer Vacation.
Newell C. Kephart and Henry A. Mazzoni 30

Industrial Medicine. J. J. Johnson 36

EDITORIALS 41

TRANSACTIONS OF THE ACADEMY
Report of annual meeting of Academy. Virginia Huck 43

CURRENT COMMENTS 51-54

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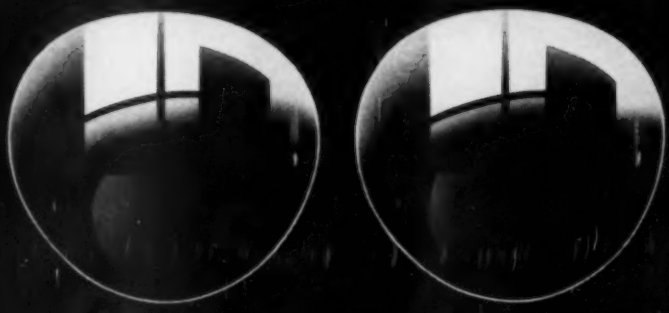

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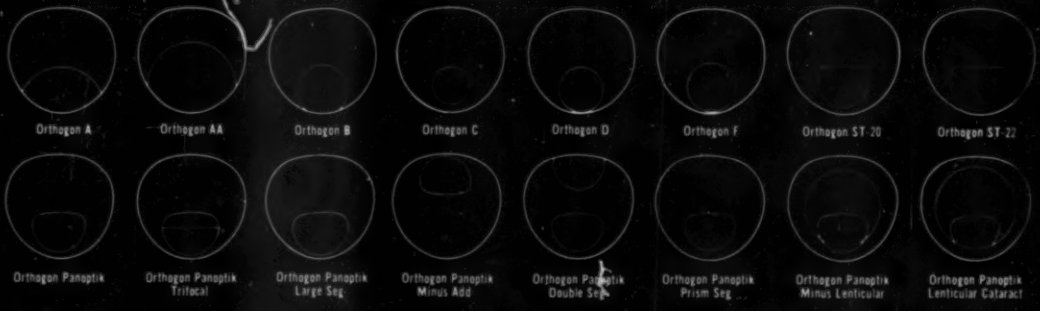

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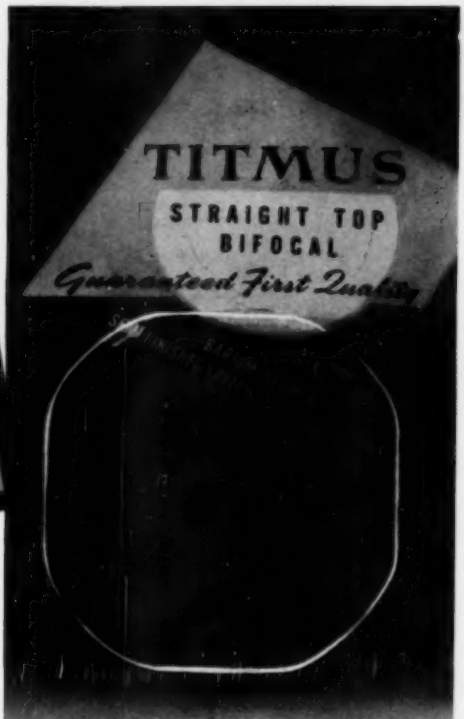

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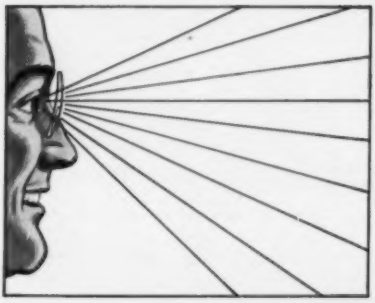

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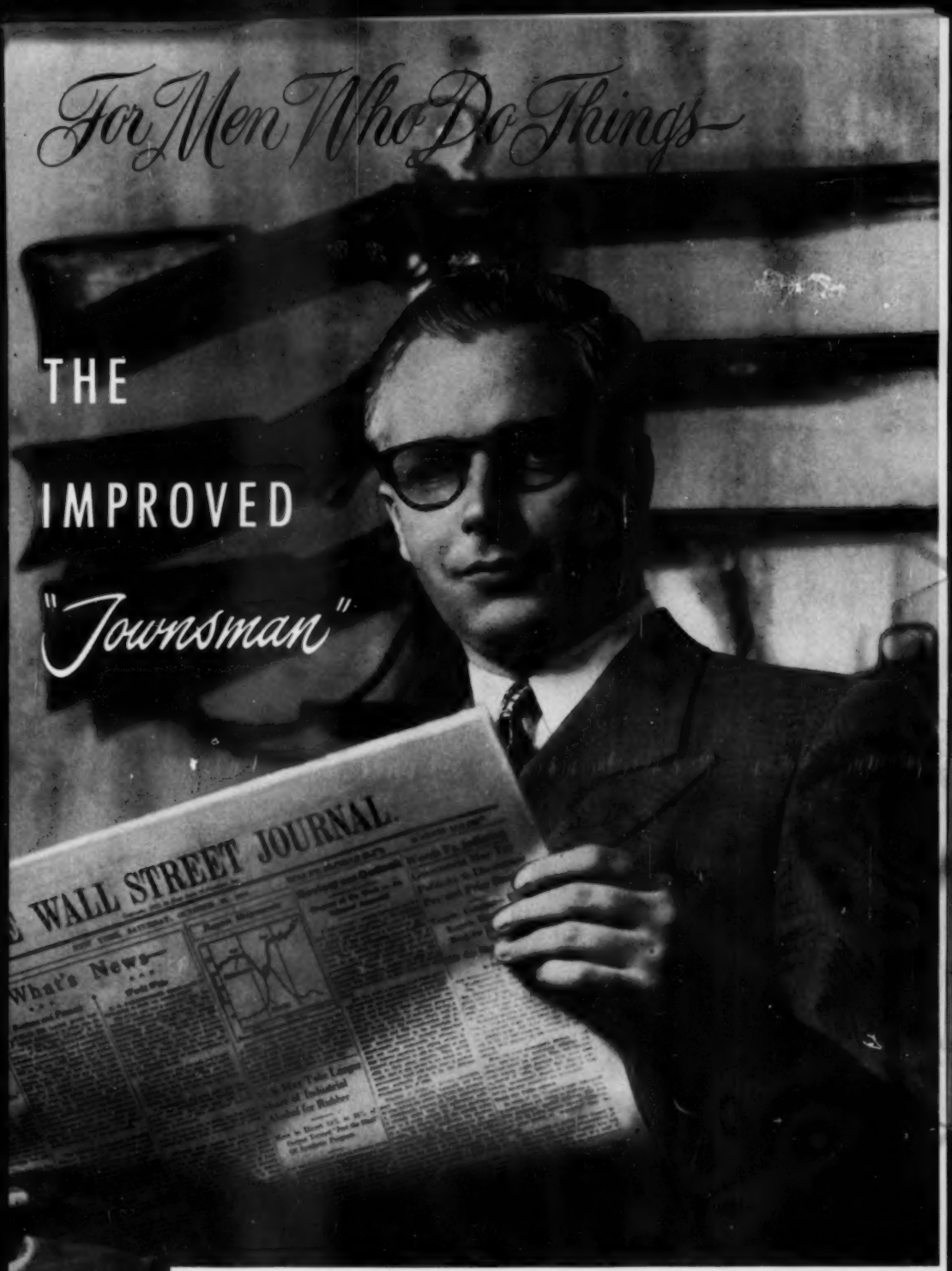

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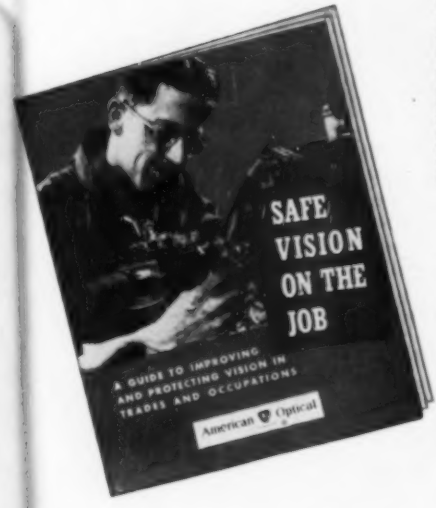

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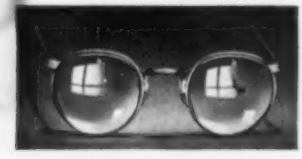

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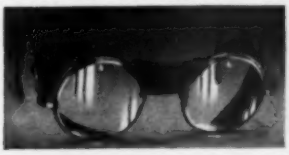

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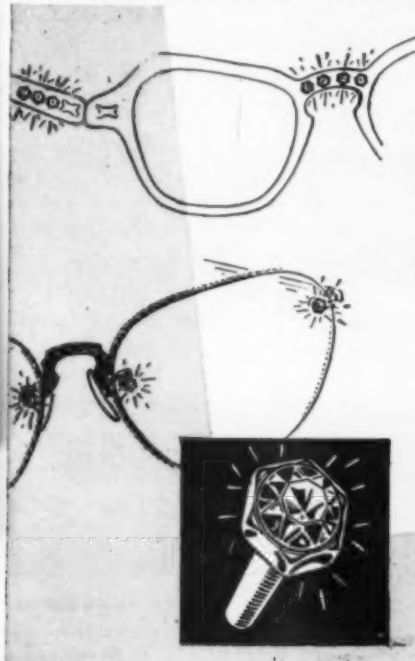

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Vol. 28 January, 1951 No. 1

ACCOMMODATIVE-CONVERGENCE IN PRESBYOPIA*

Meredith W. Morgan, Jr.† and Henry B. Peters‡
School of Optometry, University of California
Berkeley, California

Accommodative-convergence is that portion of convergence which is directly stimulated by a change in accommodation. This theoretical concept has considerable clinical importance; yet, in spite of its importance, there is no commonly accepted method of measuring the magnitude of the function. Since the results of any measurement depend on the method, a brief description of the gradient method of measuring accommodative-convergence is given here as a preliminary consideration to the main problem.

Very simply, the gradient is determined from two near phoria measurements. The first near phoria is made in the customary manner. Particular attention should be paid to the accommodative state. The target should have small detail and the patient must be constantly urged to keep the fixation target clear and distinct. Immediately after taking this ordinary phoria, a +1.00 D. sphere is added and the near phoria is measured again with this added plus lens in place. The difference in the two phoria measurements is then said to represent the change in convergence for a unit change in accommodation.

The attempt is thus made to keep all factors constant except for the change in accommodation. The only real change in the situation has been the addition of a +1.00 D. lens. It is probably true that there is a slight enlargement of the image due to the added plus lens which might influence proximal convergence. To date, however, there seems to be no evidence that this is true. In addition to the constancy of the stimulus situation, there is the additional advantage in the gradient method of measuring the accommodation-convergence in that the abso-

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†Optometrist. Ph.D. Member of faculty. Fellow, American Academy of Optometry.
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lute level of accommodation and the absolute level of convergence need not be known. A relative change in one function is measured as induced by a known specific change in the other. An objection which could arise to the gradient method is that the eye has a depth of focus of about 0.75 D. Thus the +1.00 D. lens might not induce a 1.00 D. change in accommodation. To some extent this contention is probably true. In addition lens effectivity may become a problem when the ametropia is more than 5.00 D. The general clinical assumption that accommodation occurs in the lens plane does not ordinarily lead to serious error. However, when the ametropia is relatively great there is an error introduced. Myopic subjects accommodate less than the apparent clinical amount and hypermetropic ones accommodate more. Hence a subject with myopia may have a low gradient response as compared to a subject with hypermetropia just because the +1.00 D. lens placed in the lens plane represents different amounts of physical stimulus to the two subjects.

It is well known that accommodation lags behind the dioptric value of the fixation distance. This is demonstrated by the fact that there is a "with" motion in dynamic skiametry. This lag can be measured by finding the neutral position behind the fixated target, making the dynamic skiametric measurement after the method of Nott.[1] In the Nott method of dynamic skiametry, the point of observation is behind the point of fixation. The fixation distance is kept constant for the subject. The operator then gradually increases the observation distance until the "with" motion disappears (neutral) or "against" motion becomes apparent. The dioptric difference between the fixation distance and the observation distance is then said to represent the lag of accommodation. In this method, the lens power before the subject's eyes remains constant so that the stimulus to accommodation also remains constant. Krasken and Golder[2] using this method state, "The results demonstrate that with fixation at 13, the lag of accommodation behind convergence has a range of 0.50 D. to 1.10 D. when the fixation target is a small vertical inked line and a range of 0.50 D. to 1.00 D. when the fixation target is a small white vertical line bounded by two small inked lines." Similar results are obtained if these measurements are made using a haploscope.[3] It would thus appear that the average subject accommodates as little as possible when fixating a near target. This means that a considerable portion of the depth of focus is utilized. Hence the addition of any plus lens may not necessitate a change in the accommodative state. There is some evidence, however, that accommodation is changed when the plus lenses are added. As was mentioned above, when the Nott method of dynamic skiametry is practiced the lag

of accommodation is between 0.50 D. and 1.00 D.; yet, when the usual method for dynamic skiametry is used and the stimulus to accommodation changed by the added lenses, the lag is between 1.00 D. and 1.75 D.[4] This difference is due to a change in accommodation as the convex lenses are added. The +1.00 D. lens used in the gradient determination probably inhibits accommodation nearly 1.00 D.

There have been two reports of results of gradient measurements on non-presbyopic subjects. The first of these was by Morgan[4] in 1944. He reported that the mean value to the nearest whole unit was 4Δ/1.00 D. with a standard deviation of ± 2.0Δ. Morgan pointed out that there was not normal distribution since the mean ± one standard deviation accounted for 84% of the subjects. The second report was by Emmes[5] in 1949. Emmes found the mean value to be 3.12Δ/1.00 D. with a standard deviation of ± 1.64Δ. His data indicate that about 90% of all his subjects are included in the range of the mean ± one standard deviation.

Since the near phoria is a preliminary finding in any gradient measurements it is of interest to consider the mean and standard deviation of this function. There have been a number of reports on this measurement in the past. Unfortunately many of these do not state whether or not any of the subjects included were presbyopic. These range from a high of 6.6 Δ exophoria on 48 subjects[6] to a low of 1.02 Δ of exophoria on 100 subjects.[7] Haines[8] reports a mean value of 4.85 Δ exophoria on 1,000 subjects; Vivian,[9] 3.96 Δ exophoria on 2,172 subjects; Eames,[10] 2.21 Δ exophoria on 302 subjects; Morgan,[11], 3Δ exophoria on 800 subjects; Shepard,[12] 5Δ exophoria; Hirsch and Bing,[13] 4.22 Δ exophoria, 4.64 Δ exophoria and 3.36 Δ exophoria, depending on the method of measurement; and Manas[14], 4.5 Δ exophoria on 792 subjects. The standard deviation in these reports is about 4.5 Δ. It would seem then, that the near phoria has a value between 1Δ to 6Δ of exophoria with the most probable finding being either 3Δ, 4Δ, or 5Δ of exophoria.

In order to test the effect of presbyopia on the near phoria and the gradient determination, each of us (Peters and Morgan) tested these functions on 200 consecutive presbyopic patients. For purposes of this investigation a presbyopic subject was taken to be a person with an amplitude of accommodation of less than 4.0 D., and more than 45 years of age. The near phoria was taken through an "add" since obviously the test is without meaning unless the subject can see the fixated target clearly. In addition to the near phoria taken through the add prescribed, the phoria measurement was taken through the add −0.50 D. and through the add +0.50 D. The gradient was taken

to be the difference in the phoria measurements between the add —0.50 D. and the add +0.50 D.

The departure from the customary method of making the gradient measurement was made necessary by the fact that these subjects were presbyopic and therefore when the add exceeds +1.50 D., a +1.00 D. lens cannot be added and still have the subject see the target clearly at 40 cm. The accuracy of the measurement may be reduced somewhat by this method. This is particularly true when one considers the fact that the smaller pupil of the presbyope increases his depth of focus. In spite of this probable error, it was considered the measurement was important enough to make since it has some rather far reaching implications.

In Table I are given the prescribed adds for the various subjects.

TABLE I

Add	No. by Peters	No. by Morgan	Total
+1.00	0	5	5
+1.25	14	12	26
+1.50	36	34	70
+1.75	67	68	135
+2.00	61	60	121
+2.25	20*	18*	38
+2.50	2*	3*	5
	200	200	400

*Obviously some blur when +0.50 D. added.
The mean add prescribed was +1.77 D. and the S. D. is ± 0.27 D.

In Table II is given the near phoria through the prescribed add.

TABLE II

Near Exo Through Add	No. by Peters	No. by Morgan	Total
3	2	3	5
4	4	4	8
5	5	6	11
6	9	8	17
7	35	30	65
8	24	35	59
9	39	37	76
10	31	30	61
11	27	22	49
12	8	9	17
13	7	8	15
14	5	4	9
15	3	4	7
16	1	0	1
	200	200	400

The mean near phoria for the 400 subjects through their prescribed add is 9Δ exophoria. The S. D. is ± 5.5Δ.

In Table III are given the gradients.

TABLE III

Gradient	No. by Peters	No. by Morgan	Total
0Δ/1.00D	4	2	6
1Δ/1.00D	18	20	38
2Δ/1.00D	20	22	42
3Δ/1.00D	39	36	75
4Δ/1.00D	52	53	105
5Δ/1.00D	37	35	72
6Δ/1.00D	24	26	50
7Δ/1.00D	6	6	12
	200	200	400

The mean value for the gradient was 3.8Δ/1.00 D., with a standard deviation of ± 2.6Δ.

It will be noted immediately that this mean value compares very closely to that reported for non-presbyopic subjects (4Δ/1.00 D. and 3.1Δ/1.00 D.). If the method of measurement is accurate, it seems obvious that the gradient or the A. C. A. ratio is not greatly different in a group of presbyopic persons than from a group of non-presbyopic subjects. The assumption might be made that the A. C. A. does not change significantly with age. There is somewhat more scatter among presbyopic subjects than among non-presbyopic subjects since the Standard Deviation is higher.

This assumption of no change in the A. C. A. with age can only be accurately checked when haploscopic measurements are available on a number of subjects made over a number of years covering the age period of from 40 to 50 years.

In the case of the near phoria there is considerable difference in the mean value for presbyopic and non-presbyopic subjects. This difference may be due to the fact that the near phoria in the presbyopic subjects was taken through an add and therefore 2.50 D. of accommodation was not in use by the subjects. This thesis can be checked by multiplying the average add by the gradient, since the gradient represents the accommodative-convergence per unit of accommodation.

Thus: $1.77 \times 3.8 = 6.7\Delta$

Now the near phoria through the add is 9Δ exophoria: therefore the near phoria without the add could be presumed to approximate

$$9\Delta - 6.7\Delta = 2.3\Delta \text{ exophoria}$$

This is very near the normal average near phoria.

There are several important theoretical considerations which may be considered from these data. The first question which one may ask deals with the apparent constancy of the accommodative-convergence accommodation ratio. Do these data indicate that there is no change in

the accommodative-convergence with age? Unfortunately, a dogmatic answer cannot be given this question. If one assumes that the accommodation changed by nearly one diopter; then it is true that there is no significant change in the gradient with age. However, one cannot be sure that the change in accommodation between the stimulus levels of the add —0.50 D. to the add +0.50 D. was 1.00 D. It has already been pointed out that the average non-presbyopic subject when fixating a near target utilizes his depth of focus and accommodates less than that implied by the fixation distance. If presbyopic subjects do the same thing, then when the —0.50 D. lens is placed over the add, a 0.50 D. of accommodation might not be stimulated. Then when this lens power is changed by 1.00 D. more plus there is a chance that something less than a diopter of accommodation is inhibited. There is some good clinical evidence, however, to indicate that in the case of presbyopia the add uses up, in a sense, the depth of focus. This is evidenced by the general practice of assuming that the deduction from the gross finding in dynamic skiametry should be reduced as the amplitude of accommodation decreases. If the accommodation does not change as much in presbyopic subjects as in non-presbyopic subjects when measuring the gradient, then the gradient increases with age since the ratio would be 3.8Δ/ less than 1.00 D.

The second question involves the concept of the myodiopter. Does a presbyopic subject expend a greater effort in accommodating 1.00 D. than does a non-presbyopic one? The problem of physiological and physical accommodation has been briefly stated by Duke-Elder.[15]

> Opinions differ as to the relation of the physical and physiological accommodation in presbyopia. Two possibilities offer themselves: either a maximum contraction of the ciliary muscle is required to produce a maximal accommodation at any age, and each fraction of the actual range of accommodation corresponds to an equal fraction of the entire contractability of the muscle; or, alternatively, the same amount of muscular contraction allows the same actual deformation of the lens, which may or may not become effective, depending on the state of sclerosis. In the latter case much of accommodation is rendered latent in presbyopia. The first alternative, suggested by Donders (1864) and Landolt (1903), is supported by Clarke (1924) and Duane (1922-1925) on the evidence of the action of drugs on the ciliary muscle. In their opinion it follows that a young person possessing 14 D. of accommodation has only to use a small fraction of his available ciliary power to increase his refraction by 1 D., whereas a person who has reached an age at which only 1 D. of accommodation remains has to use all his ciliary power to produce this effect. In the second alternative, adopted by Hess (1903) and supported by Fuchs (1922), and van der Hoeve and Flieringa (1924), a change in refraction of 1 D. calls for the same amount of ciliary contraction in both the young and the old. Sufficient knowledge is not yet available whereon to base a dogmatic opinion, but there is a considerable amount of evidence that, although the presbyope can only avail himself of a small amplitude of accommodation, the effort which his ciliary muscle expends is approximately the same as that employed by a young person with a larger amplitude. While the physical accommodation, which is an expression of the actual optical result, is therefore widely different in these cases, the physiological component, which is a measure of the effort expended by the ciliary muscle, may be approximately equal.

The clinical evidence for the approximate equality of effort is found in the fact that only rarely does a presbyopic subject complain of asthenopia: their complaint is a reduction in near visual acuity even when the amplitude of accommodation is sufficient to see clearly at 40 cms. If the effort of focus increased with age, one would expect more and more asthenopia with age instead of the reverse. One cannot, however, be positive about such evidence since it is also apparent that subjects with a reduced accommodative amplitude avoid using their depleted accommodation by holding their near work further away or avoid near work altogether. In addition if the Helmholtz, Gullstrand, Fincham theory of accommodation is correct, then the only effect of the ciliary muscle is to reduce the tension on the suspensory ligament. The molding of the lens is due to the elasticity of the capsule. Further contraction of the ciliary muscle beyond the capacity of the capsule to mold the lens, should result not in greater accommodation but in a sinking of the lens due to the action of gravity. Each diopter of accommodation would always require the exact same relaxation of the suspensory ligament regardless of the sclerosis of the lens material.

Now accommodative-convergence seems to be connected with accommodation by some central association. In other words, the association is on the innervational side of the reflex rather than a connection with the effector. Thus if a presbyopic subject requires more effort to accommodate 1.0 D. than does a non-presbyopic subject, the associated accommodative-convergence should be greater; that is, the gradient should be higher in presbyopic persons than in non-presbyopic. The data here indicate that this is not the case if the assumptions regarding the changes in accommodation made above are correct. The fact that the gradient is practically identical would mean not only does the accommodative-convergence accommodation ratio have the same value in presbyopic subjects as in non-presbyopic but also that the physiological effort of accommodation is the same, on the average, in older persons as in younger ones.

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ABSTRACTS

THE PEORIA VISUAL SCREENING PROJECT. C. S. Turner and J. A. Potter. Illinois Medical Journal. 97.3. 1950.

Initiated in 1948 for the purpose of determining the number of school children with visual difficulties and what could be done about them, the Peoria Visual Screening Project examined a total of 12,667 grade students with the Massachusetts Vision Test.

The results indicated that approximately 18 per cent were below standard visually. The findings showed a gradual increase from 25 per cent in the first grade to 53 per cent in the eighth grade with visual difficulties. This indicates that visual problems increase as the child advances in school.

It is interesting to note that of those found to be below minimum visual standards, only 21 per cent obtained professional care. The authors stress the importance of a small advisory committee representing both the professions of ophthalmology and optometry.

In order to overcome the lack of follow-up of unresponsive parents and to urge them to obtain proper visual care for their children, it is felt that this part of the program would be helped by assigning the follow-up work to public health nurses.

R. E. B.

CLINICAL SIGNIFICANCE OF THE ABDUCTION FINDINGS*

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In tracing the history of ocular refraction we find the earliest practitioners were concerned only with refractive errors. As our fund of knowledge regarding physiological optics increased, it became apparent that more was involved in refraction than simple correction of the refractive error. Some of the earliest investigators in the field of refraction who expressed this opinion are, first, Donders and, later, Percival. Donders in his early works demonstrated by experiment that a relationship exists between accommodation and convergence. If a relationship exists between these two functions as Donders postulated, then the fixation position of the eyes should be considered by the optometrist in arriving at the final prescription for a refractive error.

The view-point that the final position of the eyes should be considered in making up the prescription was further expounded by Percival who suggested a working clinical hypothesis and established a criterion of the accommodation-convergence relationship which made it possible to judge the degree of comfort or discomfort that a patient might expect from a given prescription. Percival's hypothesis is well known to optometrists today and is an approach which can be applied in many cases. Percival stated that his hypothesis was entirely empirical drawn only from clinical experience with no statistical substantiation but that it might be useful. In brief form, this hypothesis states that a patient will be comfortable if the point of demand[1] falls within the middle one-third of the zone of clear, single binocular vision for any point one-third meter distant or beyond. With distance fixation this presents some clinical problems because a careful check of clinical findings shows that many patients have the point of demand very near the end of the central third of the range between the abduction break and adduction blur points. It was this fact which led the author to carry out the investigation presented here. First, it should be pointed

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[1]The point of demand is the point showing the amount of convergence and the amount of accommodation in use when a patient fixates at a given distance. For ⅓ meter fixation 18Δ of convergence and 3 diopters of accommodation are in use. Percival used a graph to demonstrate these relationships.

out that Percival was not concerned with the phoria findings, either at distance or at near, since he found many patients who were comfortable even though the phorias fell outside of this middle-third zone of comfort. His only concern was with the relationship of the point of demand.

The specific problem considered in this investigation is that of the basic, fundamental relationship existing between the tonic phoria position and the abduction break point for fixation at infinity. The tonic phoria position with distance fixation is the positon assumed by the eyes when all accommodative effort is relaxed and fusion broken for a reasonable length of time. This phoria position has been called by various authors the "fusion free position," the "tonic phoria," and the "position of rest" of the eyes. The phoria position differs from the absolute position of rest of the eyes in that the tonic contraction impulses to the extraocular muscles are effective in the phoria position but non-effective in the absolute position of rest. The absolute position of rest is assumed only when no tonus is present, such as in coma, death, etc.

The abduction break point was chosen because in this case there are no secondary effects from a lowering of the accommodative level as base-in prism is added. In all other convergence measurements, the accommodative level is likely to be affected and has to be considered. The work of Haines has shown the relationship between the distance phoria and the base-in to break position for 443 cases. The phoria positions fell between 1 diopter of esophoria and 1 diopter of exophoria while the break point occurred between 8 prism diopters and 11 prism diopters. If we consider the true abduction as the dioptric distance between the phoria and the break point, we then find the true abduction in these cases to be between 8 and 11 prism diopters. The relative stability of the abduction break point is mentioned by Hofstetter when he says, "The diagram shows that the variations in relative convergence are to be accounted for by changes in the positive side while the negative side and the phoria position remain constant. Furthermore, such changes occur without any change in the slope of the zone." He makes this statement as the result of the investigation of the effect of orthoptics on the relative convergence findings. Furthermore, haploscopic investigations by Morgan, Fry, Hofstetter, Hess, and Pereles have all failed to reveal any cases where the negative relative convergence ever exceeded the abduction break at distance when due allowance was made for the variation in fixation distance.

The viewpoint of Fry is amply expressed by the following quo-

tation taken from his article on the "Relationships Between Phoria, Blur, Break and Recovery Findings at the Near Point." This explanation has been duplicated by other authors and reprinted in various portions of the literature.

> In the first place, the base-in break finding at near is determined by the absolute limit of divergence in most cases. In order to demonstrate this relationship the base-in break findings at near were plotted against base-in break findings at distance. The diagonal line represents those cases in which the base-in break point at near corresponds exactly to the absolute limit of divergence as determined by the base-in break findings at distance. In comparing the findings at the two distances a 15 prism diopter allowance must be made for the increased initial convergence at the near point. In general it can be said that the major factor determining the base-in break point at near is the absolute limit of divergence. This means that the blur-break range on the base-in side is primarily a measure of the accommodative-convergence associated with 2.50 D. of accommodation, and cannot be regarded as an index of different degrees of ability for decreasing convergence by voluntarily relaxing accommodation.

The abduction break point at infinity was chosen also because in this particular measurement only negative fusional convergence is being measured since no accommodation is in play. In taking near-point findings we cannot be too sure just what type of convergence is operating. Although theory is fairly well established, there is still no positive proof of the exact inter-play of the various types of convergence in the case of negative relative convergence measurements. When the abduction at distance is being measured the only possible reflex present would be fusional convergence, since the target is placed at clinical infinity and accommodation is not in use. The phoria and duction relations with distance fixation should be very direct and variables should be easier to detect here than in near-point technique.

These relationships are made still more direct with fixation at infinity because of the lack of relative accommodation under these conditions. The results of early investigators show little or no relative accommodation at the far-point of convergence (Parallelism). This viewpoint is expressed by the following quotation from Fry:

> Most of the cases indicate that the relative accommodation does become zero at both the near limit and the far limit of convergence. In a few cases, however, a certain amount of relative accommodation is manifest at one or the other of the limits of convergence. In the case described by Percival there is indicated a relative range of accommodation at the far point of convergence. This investigator is the only one encountered whose data show this peculiarity. It may be due to some artifact but this is not apparent in the description of the experiment. The data published by many investigators such as Donders, Landolt and Howe do not extend beyond parallelism and hence throw no light on the problem of relative accommodation at the far point of convergence. The data obtained with haploscopes by Pereles, Hess and the writer all definitely show that the relative accommodation becomes zero at the far point of convergence.

This type of relationship was demonstrated in the vertical meridian by Ellerbrock and Fry when they measured the vertical phoria and duction relationships in anisometropic corrections. A direct quotation from their paper will express the fundamental problem very clearly:

The question might now be considered whether this capacity for differential adjustment of the position of rest at various levels is related to the fusion mechanism of the eyes. It might be supposed, for example, that if a person were wearing a minus lens over the right eye and a plano lens over the left eye, and if he were instructed to look at an object straight ahead, the right eye might automatically make a subductive movement to overcome the base-down effect in the upper part of the minus lens; and if he were instructed to change to an object at the reading level, the right eye would automatically switch over from a subductive to a supraductive movement. If the compensatory adjustments which the eyes make in switching from one level to another do actually involve a manipulation of the vertical fusion mechanism, as described above, one would expect the limits of the duction range to remain relatively stable in switching from the straight ahead to the reading position, but the phoria would switch from one side to the other of the mid-point of the duction range. The possibility of this happening can be tested by comparing the phoria finding with the midpoint of the duction range. Although the net phoria findings vary over quite a wide range as compared with each other they seldom deviate to any great extent from the midpoint of the duction range.

The following conclusions can be drawn from this investigation:

(1) The anisometrope develops a capacity for compensating prismatic inequalities at the straight forward and the reading positions. This is demonstrated by the fact that the gross phoria is found to be approximately zero at both positions.

(2) There is certain evidence that these compensatory adjustments vary continuously from one part of the field of fixation to another.

(3) As the phorias become adjusted to the prismatic inequality at the two positions, the midpoint of the duction range shifts accordingly.

The conclusions of Ellerbrock and Fry support the viewpoint that as the tonic phoria changes, the pure fusional movements tend to follow in the same direction. Following this line of thought, we should expect that a patient having a higher exophoria than the normal would consequently demonstrate a higher abduction break point which would result in the same true abduction value as that for an average patient. If this reasoning is correct, the true abduction should be a direct expression of the patient's fusional ability as well as an adequate clue to the position of his tonic phoria. It is the latter view-point which I feel has the more important clinical application.

Selection of cases: The cases used for this investigation were selected so as to eliminate extraneous factors and obtain a tonic phoria measurement. One of the criteria used was to have no vertical unbalance. No patient with a significant anisometropia was selected. (No anisometropia over one-half diopter was considered acceptable.) No case of high astigmatism was used and all cases with astigmatism were of the symmetrical type. The astigmatic error in no case exceeded 1.50 diopters and the majority were from 0.25 to 0.75 diopters.

Cases were selected with as low an error as possible and never exceeding 3 diopters. This was done in an effort to minimize the decentration factor which may give false prismatic readings as the patients' visual axes deviate from the optical center of the correcting lenses. The youngest patient was age 13, with the age group spreading over the range to as high as 63, thus giving a wide base for our conclusions. Younger and older patients than these were not used because

of the desire for a dependable patient reaction. All ametropias were corrected so that the visual acuity in each eye monocularly and binocularly was 20/20 or better for every patient.

All modern techniques for the determination of the presence of a hypertonus or of an accommodative spasm were used, including dynamic retinoscopy and the consideration of the balance of the near point findings. None of the subjects selected showed any indications of a hypertonus from a consideration of these tests. None of the cases selected had exhibited any tropia at any time according to a carefully taken history.

Technique: All measurements were made with the patient wearing a correction which gave 20/20 visual acuity with maximum plus power. The patient was instructed to view the 20/20 line on a visual acuity chart shown through a mirror over total distance of 21 feet. The subject was instructed to tell the examiner when two blocks of light appeared in vertical alignment. Diplopia was obtained by adding 6 prism diopters base-up over the left eye. The bottom image was moved to the patient's right by the addition of from 12 to 15 prism diopters base-out by means of a Risley prism.

A minimum of three successive determinations of the phoria were made. If necessary, determinations were continued until a consistent reading was obtained for at least three successive trials. This was then considered the tonic phoria position. Fusion was then re-established by eliminating all prism in front of the eyes. The patient was again instructed to look at the 20/20 line of letters at a 6 meter distance while prism base-in was added binocularly until the patient reported a diplopia. Three successive readings were again made or a series of readings was made until three successive determinations agreed. This was then recorded as the gross abduction finding. If consistent readings for either the phoria or the abduction break could not be obtained, the case concerned was not used in the analysis.

By this process, the patients selected were as free of ocular complications as could be determined readily in a routine clinical examination.

Analysis of data: In table 1 is presented the pertinent data for all cases selected. It will be noted that the true abduction is calculated as the algebraic difference between the tonic phoria position and the abduction break point. This is done because it is the belief of the author that as base-in prism is added in front of the patient's eyes no load is placed on the patient's fusional abilities until the exophoria position is exceeded.

A further study of the data will show that no patients had less than 3Δ exophoria or more than 10Δ exophoria. No patients reported a history of a tropia and no periodic tropias were evident while under examination.

Calculating the mean for the true abduction finding, we obtain a value of 9.4Δ. Thus, as a group, the patients demonstrate a fusional range with distance fixation of 9.4Δ from the phoria position to the point where diplopia occurs. The mean deviation for the 27 patients is ± 1.4Δ, indicating a range of fusional ability approximately from 8Δ to 11Δ when expressed as the true abduction value. The co-efficient of correlation on the data is sufficiently high to indicate the reliability of the data as collected on the 27 cases.

TABLE 1

Case	Exo.	True Abduction	Abduction	Age	Refractive Error
1.	4	9	13	14	O.U. —1.00.
2.	3	10	13	36	O.U. +1.00 cx 90°.
3.	3	7	10	36	O.U. +1.25 cx 90°.
4.	4	12	16	13	O.U. —.75 ⌒—.75 cx 180°.
5.	7	9	16	44	O.U. +1.00 ⌒—.75 cx 180°.
6.	6	10	16	14	O.U. +.75 ⌒—.25 cx 90°.
7.	7	9	16	44	O.U. +1.00 Add +1.00.
8.	10	8	18	41	O.U. +.25 ⌒—.50 cx 90°.
9.	8	11	19	34	O.U. +.75 ⌒—1.50 cx 5°.
10.	6	7	13	47	O.U. +.50 ⌒—.25 cx 90°.
11.	5	8	13	38	O.U. —1.00 cx 170/30.
12.	4	11	15	35	O.U. +.75 ⌒—.25 cx 180°.
13.	5	11	16	19	O.U. +.50 ⌒—.25 cx 90°.
14.	4	10	14	14	O.U. —.75 cx 180°.
15.	3	10	13	22	O.U. +.50 ⌒—.25 cx 180°.
16.	4	8	12	63	O.U. +2.00 ⌒—.75 cx 90°.
17.	4	6	10	29	O.U. +.75.
18.	3	11	14	47	O.U. +.25 Add +1.25.
19.	4	12	16	43	O.U. +.75 ⌒—.25 cx 90°.
20.	4	8	12	44	O.U. +.75 ⌒—.75 cx 180°.
21.	4	10	14	35	O.U. —2.00 ⌒—1.00 cx 180°.
22.	3	9	12	21	O.U. —2.50 ⌒—.25 cx 180°.
23.	4	9	13	17	O.U. —2.25.
24.	4	6	10	20	O.U. —.50 ⌒—.25 cx 180°.
25.	6	13	19	14	O.U. —3.00 ⌒—1.00 cx 180°.
26.	10	9	19	29	O.D. —2.00 cx 180°. O.S. —1.00 ⌒—.25 cx 90°.
27.	4	10	14	21	O.D. +3.00 cx 100°. O.S. +1.00 ⌒—.25 cx 180°.

These figures compare to a finding of orthophoria and a mean abduction finding of 9.24Δ as compiled by Haines in 443 cases for

patients who were comfortable and presented no ocular symptoms. If Haines' results are compiled by calculating the true abduction value, the value will be between 8Δ and 11Δ of true abduction. It will be noted that the true abduction values in Haines' table of expected normals thus agrees with the true abduction values as collected on ocularly comfortable patients with a considerably higher exophoria finding for distance.

Conclusions and Clinical Applications: Since the true abduction value (i. e., the fusional range between the phoria finding and the abduction break finding with fixation at distance) is relatively the same regardless of the phoria finding when measured as a tonic phoria, we can use the relatively stable abduction finding at distance as an indication of the tonic phoria position of the eyes. Granting this is possible, we now have a valuable clue as to the presence of an accommodative phoria as compared to a tonic phoria, with fixation at infinity.

In the literature many authorities agree that an esophoria at distance may be an indication of under correction of plus or overcorrection of minus. This is frequently the case. Their reasoning is based upon the relationship between accommodation and convergence. If a patient is still accommodating with fixation at infinity and fusion is broken by artificial means there will be an associated impulse to convergence resulting in an esophoria. The weakness in this chain of reasoning is the assumption that the patient would have orthophoria as the tonic position of rest. The author claims that it is just as reasonable to consider that a patient may have 4Δ of exophoria at infinity and then to set up 4Δ of positive convergence as a result of accommodation. The net result would be orthophoria. The orthophoria finding would not lead us to the correct conclusion of a possible accommodative residue remaining from undercorrection of plus or overcorrection of minus.

Since we have demonstrated a relatively stable fusional range between the tonic phoria and the abduction break point, it will be possible to differentiate between the tonic and accommodative phorias by consideration of the abduction break points. As the analysis of results indicates, the average patient should have a true abduction of 8Δ to 11Δ. If the phoria varies from the abduction break point by more than this amount (i. e., if the true abduction value is more than 8Δ to 11Δ amount) we are safe in assuming some of the remainder is probably accommodative and therefore look for a possible addition of plus power to the tentative prescription.

If the true abduction value is less than the expected value, we would be led to the conclusion that the patient has a lowered fusional ability. For confirmation of this conclusion we would have to consult other refractive findings.

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ABSTRACTS

ABSOLUTE THRESHOLDS AND NIGHT MYOPIA. J. M. Otero, L. Plaza and F. Salaverri. Journal of the Optical Society of America. 39.2. 167-172. 1949.

Various phenomena associated with night myopia have been investigated during the last decade. An apparent myopia of approximately 1 diopter has been repeatedly observed under dark adaptation conditions. In 1943, V. Ronchi reported that, when night myopia was corrected by the proper spectacles, many more stars could be seen than with the naked eye.

The authors measured the absolute thresholds of four subjects each of whose night myopia was suitably corrected by spectacles. More than 50,000 determinations were made so that statistical methods could be applied to the results. Each observer was emmetropic and dark adaptation was achieved in complete darkness for at least 30 minutes. Measurements were made with test fields which subtended angles from 30 seconds to 11 minutes for the fovea and for retinal zones 3°, 9°, and 15° from the fovea.

A 50 per cent decrease in the absolute threshold was found when night myopia was compensated. This is reasonably explained by the fact that all the luminous flux distributed in the blurred image during normal, uncorrected observation is constricted into a much smaller surface when the night myopia is corrected.

B. ROSETT.

THE EFFECT OF LIGHT ABSORBING FILTERS ON THE DISCERNIBILITY OF A TELEVISION TEST PATTERN*

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Los Angeles College of Optometry
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INTRODUCTION

For practical reasons, television is typically viewed with various amounts and types of extraneous illumination present. This means that light falls on the viewing screen itself from every luminous source within the viewing area. Such sources of light include not only actual lamps and windows, but also reflecting surfaces such as walls, floor, ceiling, furniture, and even the observers. As a consequence the television screen is somewhat illuminated even when the television tube is not functioning. While the television tube is in operation this degree of brightness due to ambient illumination remains as the "dark" portions of the television picture, contrasting with the parts of the screen made brighter by the inherent light emitted by the tube. Hence the possible degrees of contrast are limited by the range of brightness values between that produced by ambient illumination and that produced by the summation of ambient and inherent illumination.

For any two comparison points on the picture screen the contrast may be represented by the formula

$$C = \frac{B_I + B_A}{B_A} \qquad (1)$$

Where B_I = brightness attributable to inherent light.
B_A = brightness attributable to ambient light.

If a light absorbing filter is placed directly in front of the picture the "ambient" brightness will be reduced by the fact that the amount of ambient light is reduced first in its path to the picture and again in its path away from the screen. The inherent brightness, on the other hand, will be reduced only by one transmission through the filter. If the transmission factor of the filter is represented by T, then the formula for contrast becomes

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§Optometrist. Member of faculty. Fellow, American Academy of Optometry.

$$C = \frac{TB_I + T^2B_A}{T^2B_A} = \frac{B_I + TB_A}{TB_A} \qquad (2)$$

A comparison of formulas (1) and (2) shows that the contrast ratio with the filter in place is increased. This theory has been confirmed by Goldmark* by actual brightness measurements and by photographic techniques.

By the same theory one could predict that no increase in contrast would result by placing the absorbing filter directly in front of the eyes, as when one wears an ophthalmic absorptive lens.

The present experiment was designed to ascertain whether or not this increased contrast with a filter before the television screen resulted in an actual increase in discernibility of the details of a television picture. As an incidental experiment additional tests were also conducted with an ophthalmic absorptive lens in front of the eye. Because the experiment was purely exploratory and instigated by an inquiry as to the merits of a specific filter the tests were limited to the use of a single commercially available television filter† and a single commercially available ophthalmic absorptive lens.§

APPARATUS AND PROCEDURE

The test object consisted of a small rectangular section of the television screen within which was exposed a series of three almost parallel line segments from the test pattern of Channel 7 telecast in the Los Angeles area. The general design of this test pattern is shown in Figure 2. The rectangular aperture through which the three lines were seen was 9 mm. wide and 14 mm. high. The area of the test pattern was selected to obtain as nearly as possible the equivalent of a series of Koenig bars, i. e., it was chosen as near to the center of the pattern as possible so that the separation between the lines approached the width of the lines themselves. Certain limitations were inherent in the resolution of the television image itself. The aperture was formed by placing pressure-sensitive masking tape directly on the face of the television tube. The tape covered a surrounding rectangular area 75 mm. wide and 85 mm. high. The rough exposed surface of the tape was then covered with diffusing chalk to simulate the brightness of the face of the television tube itself when illuminated only by ambient light. This tape and aperture are identified as the object mask in Figure 1.

*Goldmark, Peter. Brightness and Contrast in Television. Electrical Engineering. Vol. 68, No. 3, March, 1949, pp. 237-242.

†The Hoffman Easy Vision filter. The filter and the television set were provided by the Hoffman Radio Corporation.

§The American Optical Company Calobar C.

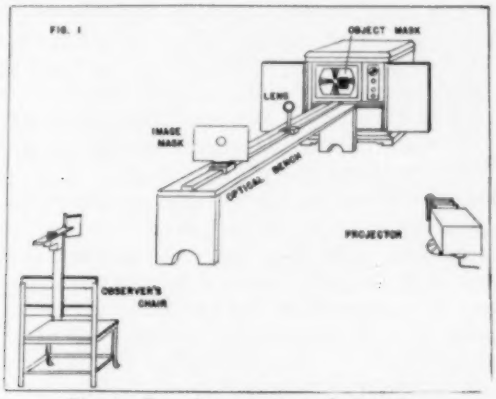

Fig. 1. General arrangement of apparatus.

As shown in Figure 1, an optical bench was mounted in front of the television screen in alignment with the object aperture. A 5 diopter lens was mounted on a sliding carriage on the optical bench to form an aerial image of the test object near the forward end of the bench. At a distance of 92 cm. from the object mask an image mask was mounted on the optical bench to frame this aerial image. The image mask consisted of a white, almost opaque, plastic sheet with a central circular aperture having a diameter of 34 mm. The image mask was rectangular in shape, 26.5 cm. high and 44.5 cm. wide, and completely blocked the unmasked portion of the television screen from the view of the observer.

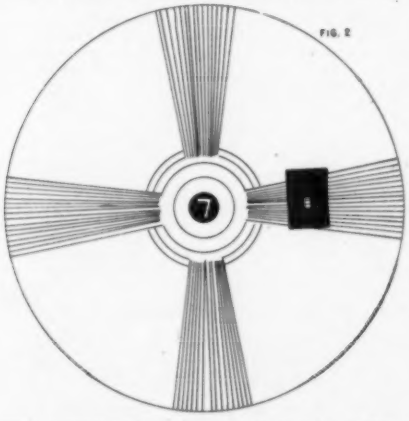

Fig. 2. Schematic representation of test pattern with object mask in place.

For all positions of the 5 diopter lens in the intermediate range of the optical bench the aerial image was formed within a few centimeters of the image mask plane and was perceived to be in the plane of the aperture when viewed from the observer's chair. For all of these intermediate positions of the lens the aperture of the image mask exposed only a portion of the surface of the object masking tape within which was contained the central test object. The rim of the lens was not perceivable to the observer except when it was at the extreme position on the lens carriage closest to the television tube.

The observer was seated in a chair with a head rest adjusted so that the distance from the image mask to the observer's spectacle plane was 3.9 meters. The television set and the optical system were elevated to place the whole viewing system at the average eye level of the seated observer. The individual observers maintained alignment by adjusting their heads until the image of the test object appeared centered in the aperture of the image mask.

The television filter was mounted directly in front of the face of the television tube. This could be placed in position or removed quickly without dismantling the rest of the apparatus. The pair of ophthalmic filters was mounted directly in front of the observer's eyes by means of a spectacle fit-over frame. Observers who wore no correction were provided with an unglazed spectacle frame with the absorptive fit-over lenses attached. These could be easily attached or removed as desired. The transmission characteristics of the television and ophthalmic filters and the emission characteristics of the television tube are shown in Figure 3. Information for these curves was obtained from the respective manufacturers.

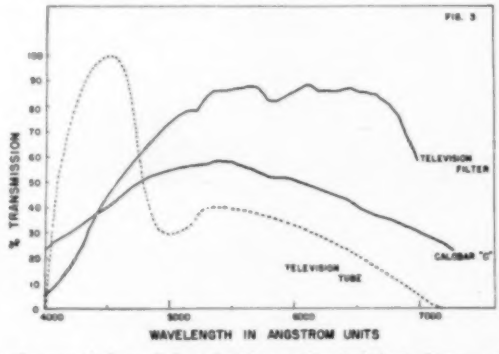

Fig. 3. Spectral transmission of the television and ophthalmic filters, and the spectral emission of the television tube (Data supplied by the respective manufacturers).

Except for the stray illumination from the unmasked area of the television tube and a relatively negligible amount of stray light from the edges of opaqued windows and doors the room was completely darkened. The light from the television tube itself illuminated the millimeter scale on the optical bench, thus enabling the operator to read the position of the lens carriage continuously.

As a source of extraneous or ambient light a lantern-type slide projector was mounted at one side of the optical bench at an angle of incidence of about 20°. An opaque mask in the slide holder defined a bright uniform image on the object mask of the television screen. The arrangement of the projector is illustrated in Figure 1.

PROCEDURE

The subjects for this experiment were all students and staff members at the Los Angeles College of Optometry between the ages of 21 and 35. All measurements were made with the subject wearing his customary glasses, if any. The subjects included several ametropes of moderate degree, but all subjects had 20/20 or better acuity with their customary glasses on. All tests on each observer were made in a single sitting or visit, the time for each complete set of tests on one observer running from forty to sixty minutes. Rest periods of a few minutes were taken between groups of observations whenever the subjects desired. The total procedure for each subject consisted of sixteen parts or series with from six to nine settings or readings in each series. The sixteen series were in the following sequence:

Series	I.	Without	ambient	light,	without	T V	filter,	without	ophthalmic	filter.
Series	II.	Without	ambient	light,	with	T V	filter,	without	ophthalmic	filter.
Series	III.	Without	ambient	light,	without	T V	filter,	without	ophthalmic	filter.
Series	IV.	Without	ambient	light,	with	T V	filter,	without	ophthalmic	filter.
Series	V.	With	ambient	light,	without	T V	filter,	without	ophthalmic	filter.
Series	VI.	With	ambient	light,	with	T V	filter,	without	ophthalmic	filter.
Series	VII.	With	ambient	light,	without	T V	filter,	without	ophthalmic	filter.
Series	VIII.	With	ambient	light,	with	T V	filter,	without	ophthalmic	filter.
Series	IX.	Without	ambient	light,	without	T V	filter,	with	ophthalmic	filter.
Series	X.	Without	ambient	light,	with	T V	filter,	with	ophthalmic	filter.
Series	XI.	Without	ambient	light,	without	T V	filter,	with	ophthalmic	filter.
Series	XII.	Without	ambient	light,	with	T V	filter,	with	ophthalmic	filter.
Series	XIII.	With	ambient	light,	without	T V	filter,	with	ophthalmic	filter.
Series	XIV.	With	ambient	light,	with	T V	filter,	with	ophthalmic	filter.
Series	XV.	With	ambient	light,	without	T V	filter,	with	ophthalmic	filter.
Series	XVI.	With	ambient	light,	with	T V	filter,	with	ophthalmic	filter.

The procedure for each setting consisted in placing the movable lens sufficiently forward, away from the television screen, to make the image of the test pattern so small that the lines were not distinguishable, then moving the lens slowly backward until the observer reported the three lines to be "resolved" as a set of three lines. The position of the

lens carriage on the optical bench was then recorded as a discernibility reading. This was repeated five more times with slightly varying starting positions and slightly varying speeds. The subject was not informed as to readings or trends at any time during the experiment. If the subject declared or believed that any given setting was a poor one it was automatically discarded and another reading taken in its place. If the subject for any reason recommended that additional settings be made in a given series, this was done without discarding any individual readings. If the operator noticed any unusual variance in settings he arbitrarily added two or three more settings without discarding any of the original. In this way the number of settings in each series actually varied from six to nine. The subject was not informed as to the number desired or to be anticipated for each series.

Eleven subjects completed Series I to XVI inclusive. Three additional subjects, B.A., D.C., and L.H., completed only series I to VIII inclusive.

RESULTS: SERIES I TO VIII

The mean values of settings obtained for each of the fourteen observers completing Series I to VIII are shown in Figure 4. The first thing evident upon studying this histogram is the variation between

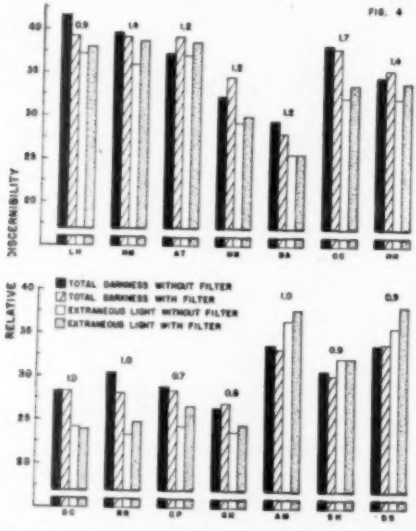

Fig. 4. Relative discernibility scores for fourteen observers wearing their regular spectacle corrections. (The higher the discernibility score the smaller the test image.)

observers. To some extent this variation may correspond to individual differences in visual acuity, but the comparison on the "repeat" series indicated that another important factor was the observer's choice of criterion in reporting when the test lines appeared to be resolved. Characteristically each observer showed high repeatability in a single series, but in a few cases the later "repeat" series showed a marked shift in average reading, but with a corresponding degree of repeatability within the repeat series. That is to say, the mean of the settings in one series of readings occasionally differed several centimeters from the mean of the repeat series with variations of only a centimeter or so within each series. This phenomenon was, of course, the exception rather than the rule. An index of the repeatability of the settings made by each observer is shown above each cluster of four histogram bars in Figure 4. This index is computed according to the formula:

$$\frac{\frac{\Sigma X_{I,III}}{N_{I,III}} + \frac{\Sigma X_{II,IV}}{N_{II,IV}} + \frac{\Sigma X_{V,VII}}{N_{V,VII}} + \frac{\Sigma X_{VI,VIII}}{N_{VI,VIII}}}{4} \qquad (3)$$

in which $\Sigma X_{I,III}$ = the sum of the deviations of the individual settings from the mean of Series I and III combined; $N_{I,III}$ = the total number of individual settings in Series I, and III; etc. Hence, the index represents the mean of the mean deviations in the four test conditions represented in the first eight series. For example, subject L. H. in Figure 4 showed an average setting error of 0.9 Cm. in the four test conditions represented in the histogram.

It can be seen in the figure that the differences in bar lengths bear little relationship to the average setting error.

The individual sets of data do not give a perfectly clear cut answer as to the benefits of the television filter so far as resolution is concerned, but taken as a group they indicate an improvement in discernibility when the filter is used as a means of cutting down the effect of the ambient light. With ambient or extraneous light present eleven of the fourteen observers showed better discernibility with the filter than without, two (B.A. and S.H.) showed no difference, and one (D. C.) showed a slight but apparently insignificant reversal (0.2 Cm). In total darkness, i.e., in the absence of ambient light, the filter apparently had no significant effect on the discernibility. Five showed apparent improvement with the filter, eight showed poorer scores with the filter, and one showed identical scores with and without.

It is of some interest to note that three of the observers (A. M., S. H., and B. S.) showed higher discernibility scores with ambient light present than in total darkness. This is paradoxical in view of the

obvious fact that the contrast was greatly reduced with the ambient light present. There were, of course, a number of other variables that would have to be considered in a final analysis of the factors involved, among which might be included the decrease in pupil size and the increase in contrast at the border of the image mask when the ambient light was present. These three subjects were recalled and retested approximately two weeks after the original tests and two of the three persisted in showing this paradox.* No immediate explanation was apparent. It suggests, however, that one factor was, as before mentioned, the change in criteria of resolution in the two testing situations.

In Figure 5 is shown a composite histogram of the average results of the same fourteen observers. A difference in discernibility with and

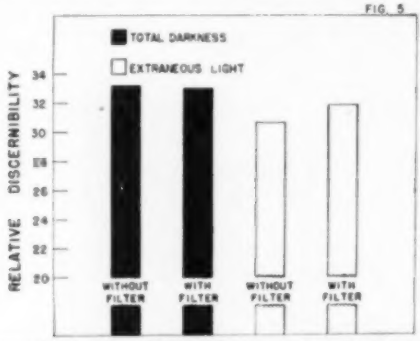

Fig. 5. Composite relative discernibility scores for the fourteen observers shown in Fig. 4.

without the television filter in the absence of ambient light again is not apparent in this analysis, but a significant improvement is apparent with the use of the filter when ambient light is present. The average improvement is of the order of about 10 per cent when analyzed in terms of relative image size and expressed as equivalents on the conventional Snellen acuity scale. On the same relative scale the individual subjects showed improvements varying from small minus values to values considerably in excess of 10 per cent.

The lack of improvement when the filter is used in the absence of ambient light suggests that the selective spectral absorption accomplished by the filter is not a significant factor in discernibility, as might be suspected from an inspection of Figure 3. The use of the filter produces a very noticeable change in overall color composition, a slightly bluish tint being quite apparent without the filter, an amber

*The recheck data were not incorporated in the data of this report.

tint being quite pronounced with the filter. There was considerable disagreement among the observers as to the relative "pleasantness" of appearance with and without the filter. These reports were based only on very casual observations, however.

RESULTS: SERIES IX TO XVI.

The results obtained with the ophthalmic filter in front of the observers' eyes were not as conclusive as the previous findings. These

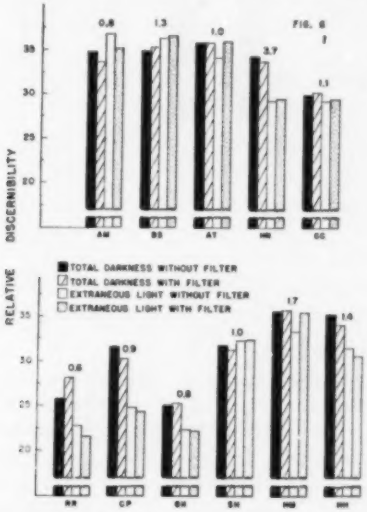

Fig. 6. Relative discernibility scores for eleven observers wearing an ophthalmic absorptive filter in addition to their regular spectacle corrections.

were the results obtained in Series IX to XVI on eleven of the fourteen subjects. The results are shown in Figures 6 and 7. The design of the histograms in these two figures represents the same analytical procedure used in Figures 4 and 5 respectively.

In the absence of ambient light five subjects showed greater discernibility without the television filter, five showed greater discernibility with the television filter, and one showed no difference. The comparison of the averages for the whole group as shown in Figure 7 shows likewise no difference in discernibility with and without the television filter when the ophthalmic filter was worn.

With ambient light present five subjects showed greater discernibility without the television filter, five showed greater discernibility with the television filter, and one showed no difference. The grouping

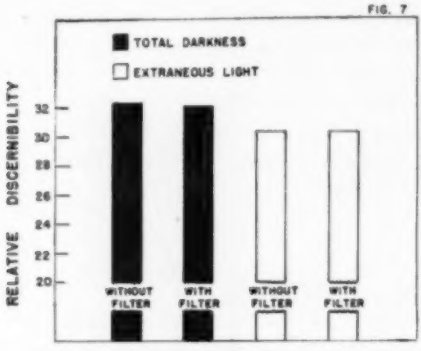

Fig. 7. Composite relative discernibility scores for the eleven observers shown in Fig. 6.

of five, five, and one in this series did not correspond in identity to the groups of five, five, and one mentioned in the preceding paragraph, which helps to confirm the inference that these groupings are pure chance. In the composite histograms in Figure 7 the same lack of improvement with and without the filter in the presence of ambient light is apparent.

COMPARISON OF RESULTS

It must be realized that the results obtained while the subjects wore the ophthalmic filter neither confirm nor refute the inferences derived from the first half of the investigations. A possible explanation of the results can be derived from a comparison of the four bars in Figure 5 with the four bars in Figure 7. All of the bars in Figure 7 are shorter than the corresponding bars in Figure 5. This means that the ophthalmic filter reduced the discernibility scores in every test situation. Insofar as the use of a filter in front of the eyes does not effect an increase in the contrast ratio, as does a filter directly in front of the television screen, it may be inferred that the overall reduction in brightness itself is a significant factor in discernibility of the television test pattern. If this is a factor in the use of the televison filter alone, the resultant loss in discernibility is obviously outweighed by the increase in contrast ratio. In the case of the ophthalmic filter alone there is no increase in contrast to compensate for the loss of discernibility due to the overall reduction in brightness. In this particular investigation it seems very possible that the excessive reduction in overall brightness effected when both the ophthalmic filter and the television filter were in use exactly cancelled out the discernibility improvement to be expected by the increased contrast ratio. This hypothesis could have been tested

by simply placing two television filters in sequence in front of the test pattern, but unfortunately this was not done.

As in Figure 4, Figure 6 also includes the same three subjects who showed the previously mentioned paradox of higher discernibility with ambient light present than without ambient light.

SUMMARY

A preliminary investigation was made to determine the effects of a commercially available television filter and a commercially available ophthalmic filter on the relative discernibility of a television test pattern with and without ambient light present.

With ambient light present most of the observers showed higher relative discernibility with the television filter than without. Without ambient light no significant differences were obtained.

No significant differences in relative discernibility were effected by the ophthalmic filter alone either with or without the ambient light present. When the television filter was in place, the addition of the ophthalmic filter reduced the relative discernibility slightly.

Certain theoretical implications were discussed.

ABSTRACTS

APPRAISING A MEDICAL CARE PROGRAM. Seymour Etkin. American Journal of Public Health. 38. 1551-1554. Nov. 1948.

The paper is based on a study of the operations of the Group Health Association of Washington, D. C., which provides prepaid medical service. This group employs one optometrist as part of its auxiliary medical staff and has an ophthalmologist on a part-time or referral basis. The statistics given for the work of their eye department do not differentiate optometric from the purely medical services. In 1946, the total number of clinic visits for eyes was 2,468 or an average of 12.8 visits per doctor per day on clinic duty. The physicians are on a "contract" basis rather than being employed by the group; the financial arrangements for the optometrists are not specified.

RICHARD FENTON

CHANGES IN VISUAL SKILLS OF SCHOOL CHILDREN FOLLOWING SUMMER VACATION*

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INTRODUCTION

Members of the eye professions have frequently raised a question concerning the best time to examine the eyes of children of school age. Except in cases of obvious or gross pathology, professional eye men are usually called upon to examine children's eyes as part of the complete check-up that many parents insist upon before the youngsters return to school in the fall of the year. Inasmuch as many school systems are now conducting surveys of the visual skills of pupils with optical instruments designed for this purpose, the question of the proper time for such screenings is an important one.

BACKGROUND

The current literature reports the findings of many of these mass testing programs, primarily in terms of the number or percentage of cases referred for professional care or treatment on the basis of visual scores derived from the screening procedures. The possible influence that the time of testing might exert on the scores obtained has thus far not been investigated. Research in the area of industrial vision has indicated that changes in the vision of employees result from prolonged application of the visual apparatus to tasks that require particular visual skills[1]. Kephart[2] reported results of retinoscopic examinations performed on school children before and after the summer vacation. The second clinical examination revealed a decided trend away from myopia. A study of fifth and sixth grade pupils conducted by Luckiesh and Moss[3] yielded similar results. These experimenters used three clinical tests. They concluded:

> The refractive change occurring during the summer months is toward an increase in hyperopia, or opposite in direction to that occurring during the school year.

The purpose of this paper is to report the findings of an experiment designed to investigate by means of a non-clinical visual skills test battery changes in the vision of school children.

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†Ph.D. Member of faculty.
‡Graduate student.

METHOD

Pupils in all grades from the second to the eleventh in the Norwood Public School, Norwood, Colorado,* were tested on the ortho-rater—once in May before the summer vacation period began and again in September upon their return to school. In both instances, the subjects were tested while wearing glasses, if these normally were worn. The data derived from the two testing periods were treated statistically to determine whether any significant changes in the visual skills had taken place between the first and second testings. All 12 tests of the ortho-rater were administered at each testing session. These tests are: far and near acuity-both eyes, far and near acuity-better eye, far and near acuity-worse eye, stereopsis and color discrimination at distance, and lateral and vertical phoria at both near-point and distance. Because of occasional omissions in the scoring, the number of cases reported for individual tests varies from 92 to 102.

With the exception of phoria tests, the mean score of the group on each of the tests in the May survey was compared with the mean score from the same test in the September survey. Differences between means were analyzed to determine whether they were significantly greater than chance would allow. Because an estimate of the chance probability that the second mean could exceed the first by the absolute difference obtained from the data was desired, only half the normal probability curve was used in computing the critical ratios. Correlation coefficients were computed for the two sets of scores from each test, to assist in interpreting the findings.

Results of acuity, depth and color tests are summarized in Table I.

TABLE I.
MEAN SCORES, DIFFERENCES BETWEEN MEANS, AND CRITICAL RATIOS FOR ACUITY, DEPTH, AND COLOR TESTS

Test	Mean Score May	Mean Score Sept.	N	Diff.	σ Diff.	C.R.	r
Far Acuity-Both	8.910	9.960	99	1.050	.269	3.911	.492
Near Acuity-Both	9.278	10.031	97	.753	.213	3.542	.402
Far Acuity-Better	9.437	10.398	103	.961	.248	3.869	.486
Far Acuity-Worse	7.706	8.696	102	.990	.258	3.842	.676
Near Acuity-Better	10.140	10.430	93	.290	.179	1.623	.525
Near Acuity-Worse	8.527	9.161	93	.634	.253	2.507	.328
Color	3.683	4.119	101	.436	.162	2.698	.283
Depth	3.686	3.716	102	.030	.274	.110	.512

FINDINGS

Binocular Acuity. The mean binocular acuity score made by 99 pupils in May was compared with the mean score made by the same

*The authors wish to express their appreciation to Stewart C. Lee, O.D., Montrose, Colo., for making available these test data.

subjects on this test in September. Statistical analysis revealed that the obtained difference in mean scores was highly significant. By chance alone, only once in 10,000 testings could the second mean exceed the first by 1.050, the difference obtained in this study. The Pearson Product-Moment coefficient of correlation between the two sets of scores was .49. This moderate correlation supports the conclusion that improvement in binocular distance acuity was not uniform throughout the group.

A similar comparison of the binocular near acuity scores of 97 pupils was made. The obtained difference was again highly significant. Chance fluctuations alone could produce a second mean so much greater (.753) than the first in only two out of 10,000 cases. The correlation between the two distributions of scores on this test was .38. Here again, there is evidence that the improvement in this visual skill was not consistent throughout the group, some subjects showing more than others.

Monocular Acuity. The scores made by the pupils on the monocular acuity tests, both far and near, were studied. Means for better and worse eye individually, both at near-point and at distance were compared, and the two distributions of scores from each of the four tests were correlated. The mean differences derived from the far acuity-better eye test (.961), based on 103 cases, and the far acuity-worse eye test (.990), based on 102 subjects, were found to be as highly significant as those obtained from the binocular test data cited above. The correlation between the two sets of scores for better eye was .49; for worse eye .68. These correlations indicate that improvement of acuity in the worse eye was more uniform than was improvement in the better eye. Analysis of these correlations by Fisher's *z* transformation revealed them to be significantly different.[4]

The difference between May and Steptember means for 93 pupils on the near acuity-better eye test was significant at the 6 per cent level of confidence; the mean difference on the near acuity-worse eye scale was significant at the 1 per cent level. The correlations were .52 and .32 respectively. Fisher's technique demonstrated that these r's do not differ significantly from each other.

Depth. Stereopsis scores for 102 pupils were studied to determine whether the ability of the subjects to discern depth by the binocular cue employed in the ortho-rater had changed as a result of summer activities. The mean difference (.030) computed for this subtest was not statistically significant. The correlation of .50 in the absence of any evidence of an over-all change would indicate there was considerable shifting in the scores of the individual subjects.

Color. Color discrimination test scores were available from both testing dates for 101 pupils. The difference between means (.436) from the two surveys was significant beyond the 1 per cent level. A critical ratio of the magnitude obtained would arise from chance fluctuations in only one case out of 2,500. The correlation of .28 between May and September scores leads to the conclusion that whatever improvement took place did not operate consistently throughout the group: that the difference in means can be accounted for by considerable improvement in relatively few subjects, and slight shifting of the scores of many. This is to be expected, since the maximum possible score on this sub-test is 6, and only three subjects scored below 2.

Phorias. Four phoria measurements—vertical and lateral at both near point and distance—were obtained at each testing date. Because of the nature of the scales, it was not feasible to compute mean differences in order to determine whether significant changes had occurred. The

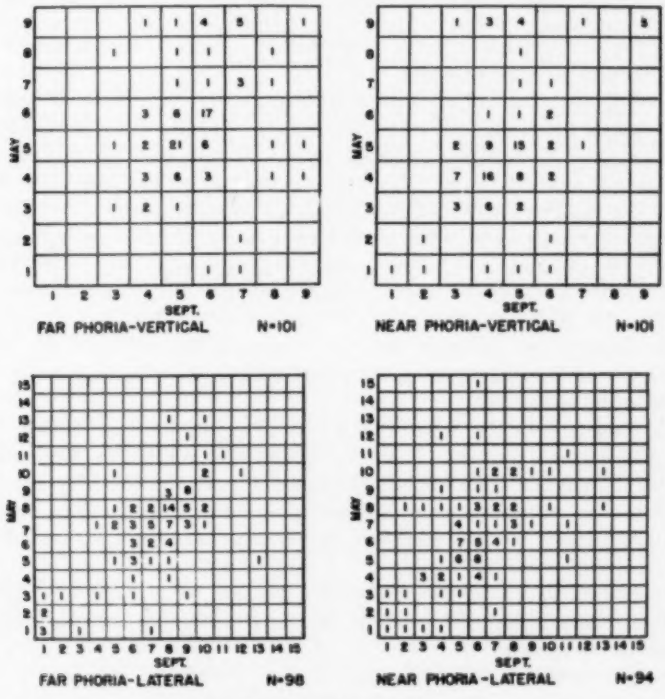

Fig. 1: Scattergrams of Phoria Scores.

results of phoria tests were investigated by correlation methods and comparison of standard deviations. There is no evidence of marked shifts in scores on three of these tests: on the fourth, far phoria-vertical, considerable shifting is evident, but no general trend can be observed. Scattergrams for these scores are shown in Figure 1. On all phoria scales, the September measures exhibited less variability than did the May scores. In the case of the vertical phoria scores at both distances, this decrease in variability was significant. Variability data are summarized in Table II.

TABLE II
STANDARD DEVIATIONS, DIFFERENCES BETWEEN STANDARD DEVIATIONS AND CRITICAL RATIOS FOR PHORIA SCORES

Test	O May	O Sept.	O May-O Sept.	O_{DO}	C.R.	r
Far Phoria-Vertical	1.74	1.20	.54	.1446	3.734	.249
Far Phoria-Lateral	2.64	2.41	.23	.1797	1.280	.705
Near Phoria-Vertical	2.03	1.42	.61	.1503	4.059	.519
Near Phoria-Lateral	2.42	2.31	.11	.2054	.536	.541

SUMMARY AND CONCLUSIONS

A group of school children in grades 2 to 11 of a Colorado public school were tested on the ortho-rater, before and after the summer vacation period. Both sets of scores from all 12 sub-tests were analyzed statistically to determine whether any significant changes in visual skills among the group had occurred between testing sessions. Highly significant differences between group means were found for the following tests: far and near acuity-both eyes, far acuity-better and worse eye, near acuity worse eye, and color discrimination. The mean difference on the near acuity-better eye scale was significant at the 6 per cent level of confidence; the difference between means on the stereopsis test was negligible. All changes were in the positive direction indicating improvement in the skills tested.

To determine the degree of uniformity of improvement among the subjects, Pearson Product-Moment coefficients of correlation were computed. The correlations obtained ranged from .28 to .68. These moderate-to-low coefficients were interpreted as indicating that the degree of improvement was not uniform for all subjects, some showing more improvement than others.

The difficulty of examining statistically the results of phoria measurements limited the analysis to correlations and comparisons of standard deviations.

The results of this study lead to the following conclusions:

1. Significant changes in acuity as measured by mean scores on

visual skill tests occur in school children during the summer vacation period. These changes are in the direction of increased acuity at the end of the vacation period.

2. No consistent pattern of changes in phoria test scores over the vacation period was noted. Less variability was noted in these scores at the end of the vacation.
3. Mean color test scores increase significantly over the vacation period.
4. Mean depth test scores show no significant change.

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ABSTRACTS

CHANGES IN VISION DURING ADOLESCENCE. A. E. Sloane and J. R. Gallagher. American Journal of Ophthalmology, 33.10. 1538-1543. 1950.

This report compares the findings at the initial visual screening examination using a modification of the Massachusetts Vision Test of 228 boys (average age. 14½ years) with the findings on the same boys three years later.

No change in the naked visual acuity of both eyes was found in 74.5 per cent of the group. There was a decrease of more than "one-line" in 7.5 per cent.

There was no significant change in the results of the tests for heterophoria over the three year period.

The authors conclude that although the frequency apd extent of the changes in visual acuity observed in this group over a three year period are not great. nevertheless. they are sufficient to suggest the desirability of an annual visual screening examination of adolescents.

R. E. B.

INDUSTRIAL MEDICINE*

J. J. Johnson†
Trenton, New Jersey

I have been asked to outline the function and organization of a medical department in modern industry, not as it pertains specifically to an eye program, but from a general standpoint to acquaint those who have recently become interested in visual problems in industry and organization of a medical department. I do not consider myself particularly qualified in the field of vision, but I have had eight years of exclusive medical-industrial practice, during which time many visual problems came to my attention. It may interest you to know that both Dr. John R. Wittekind and I worked closely with the safety department in the plant with which I was associated. During this time, our plant record for safety was such that we were in first place on a number of occasions in the safety performance records of the 80-odd General Motors plants during the war.

For those acquainted with an organized medical department in industry, many of the facts presented here will be familiar. However, it is hoped that this review will contribute some new features in this field of work.

Historically, Ramizzini, as early as 1633, crystalized much data about occupational diseases. Before him, Hippocrates, Pliny, and Galen had made their own observations, but the responsibility of the employer for certain occupational diseases and injuries was not recognized sociologically until the latter part of the eighteenth and early nineteenth centuries. In England, in 1833, factory inspection regulations were passed and in 1847 early compensation laws were formulated. Continuing through the eighteenth century with increasing impetus, the legal rights of employees became so recognized, that in 1911 an occupational disease code was established in New Jersey. The progressive attitudes of the railroad surgeons, the organization of the National Safety Council in 1913, and the establishment of the division of industrial health of the United States Public Health Service during the same year all contributed to the creation of a professional awareness and interest. The American Association of Industrial Physicians and Surgeons was established, and in 1926 the committee of industrial medicine and traumatic

*Read before the New Jersey Chapter, American Academy of Optometry, Trenton, New Jersey, as one of a series of lectures on occupational optometry. For publication in the January, 1951, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
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surgery of the American College of Surgeons came into being. In 1936, the American Medical Association assumed responsibility in the problem when it established its council on industrial health, so that, today, we have certain legal and professional stimuli to further the development of an industrial medical department.

There are certain definite objectives which must be kept in mind by the head of any medical department in any industry. The first is: emergency treatment and medical care of all employees injured or stricken with illness while on the job. Two: adequate follow-up care of the injured and the ill. Three: preventive medicine.

The medical phases of prevention of occupational disease and injury differ in part but merge with the phases which are the direct responsibility of the safety department in a large plant. For example, it is evident that an occupational accident involves three main factors. The first, the individual; the second, the environment; the third, certain variables of the first two which equate to produce an accident. This means that a good accident prevention program must have a companion program, a health maintenance program directed to the individual. The one involves maintenance of equipment and physical environment; the other involves the ever present human equation.

An industrial physician's job is to establish certain physical criteria for definite jobs or job families. It is mandatory that a pre-employment physical examination be made on every applicant, followed by a periodic examination at stated times. This not only ascertains certain basic facts before hiring, but also determines the effect of the job on the employee, and ofttimes is instrumental in discovering early pathological conditions not occurring as a result of occupation.

A physician cannot remain indifferent to circumstances which undermine the health of employees. He must be trained to recognize occupational disease hazards. It is his responsibility to review process engineering methods and to advise management of harmful chemicals or hazards in temperatures or in humidities and in proposed operations. Not only must he acquaint himself with the formal operations which originate in the engineering department, but also with the informal operations which originate in the productive departments or on the factory floor. I refer to the makeshift and "on-the-spot" methods and processes devised by the lower echelon foremen and leaders. In this respect, the plant physician must at times indeed be a watchman. We are all acquainted with the "bootlegging" of carbon tetrachloride as a cleaning agent even when the operator knows that such a cleaner is taboo. One such unauthorized use led to temporary asphyxiation of

three workers in an airplane fuselage, one morning at 3:00 o'clock. Unfortunately, we never learned where the carbon tetrachloride was obtained.

Nor is it enough to be interested in the health of the worker during his working hours. Two-thirds of a man's day is not subject to observation at first hand and we must, therefore, rely on attendance records and illness and non-occupational accident reports, as well as routine or special physical examinations to detect changes in health and changes in capabilities. It is obvious that should an employee develop asthma, he should not be transferred to a dusty occupation nor should the truck driver who has lost the vision of one eye through illness or non-occupational accident be permitted to continue as a mobile equipment operator. There may be exceptions to the latter example but certainly intense study of the case should precede such considered exceptions.

It would seem, off-hand, that the plant physician would have to be an ubiquitous, omniscient individual, as well as a qualified toxicologist and engineer, but fortunately such need not be the case. However, in any plant, organization of all chemists, engineers and others concerned in the complex problem is a mandatory and satisfactory solution.

The safety department's function is to organize the mechanical factors involved, namely: equipment, lighting, footing, and even apparel. The medical department's function is to organize the health facilities for the worker. For successful performance of a combined safety and health program the two departments must be closely coordinated.

To accomplish such coordination in one plant, a plant-wide health committee came into being. The health committee was an integration of the best talent in all the various functional and manufacturing departments of the plant. It included representatives of labor as well as of management. The complete personnel was as follows: plant physician, safety director, chief engineer, chemical engineer, maintenance supervisor, manufacturing department supervisor and the plant manager. This health committee held two meetings a month, one of which was a business meeting, and the other an inspection meeting. The inspection meeting is an unscheduled plant tour lasting approximately two hours, in which every nook and cranny of the factory area, garage, roof and any place accessible to employees is visited. As each manufacturing department is entered, the foreman is requested to accompany the health committee. In addition, certain members of the health committee are given projects or problems for repeated inspections between the regular combined inspection. At the business meeting, the findings

of the inspection tour and all significant accident reports and occupational disease reports are reviewed. In the health committee are individuals with specific knowledge to inform us concerning chemicals, production programs, processes. There are also those with the authority to condemn, modify, or approve such procedures. The health committee does not always agree in the disposition of all problems. Generally, however, an understanding is reached.

Time limits any particular reference to the effect of health on vision or vision on health. I should like to cite one incident in which an eye-man solved a problem and this incident will also point out the necessity of coordinated endeavor. One of the operations involved in airplane manufacture was to remove a part from a travelling overhead conveyor and transfer it to another conveyor leading to a "degreasor" containing trichlorethylene. It became a problem to keep an operator on that job because nausea and vertigo seized most of the operators from half a day to half a week's time on that operation. We suspected that trichlorethylene fumes were responsible and had numerous air analyses made, none of which showed more than a trace of trichlorethylene. We considered that employees were unwilling to do the job and hence feigned nausea and vertigo. We then considered the fatigue factors. Many operators, however, preferred other more difficult laborious work to that particular operation.

One of your colleagues happened to be with an inspection group and brilliantly solved the problem. As he stood in the operator's position and executed the operation of transferring the parts, he realized that the lighting was very unsatisfactory because directly in line with the point of transfer from one conveyor chain to another, and in line with the operator's vision, was a very bright overhead incandescent type bulb. He suspected "eye fatigue" and "motion-sickness" and advised baffling the light and reducing light glare. We were subsequently able to put any operator there without further complaint of nausea and vertigo. It is the "little tricks of the trade" and individual awareness of the significance of apparently minor elements of a problem that will often lead to a solution.

In summary and in a formal list, the functions of a medical department in industry are (a) To conduct pre-employment physical examination during which time vision tests are given. The importance of "vision" testing rather than "eye" testing is a subject of another paper, so I will not go into the mechanics and significance of that problem other than to say that the constitutional diseases affecting vision can be determined by the general physical examination in some

instances. (b) To conduct periodic examination to determine the maintenance of health and to classify the versatility in job performance of the individual. (c) To supervise placement of the less versatile applicant; that is, the employee who is restricted from doing certain operations because of inherent personal health or lack of it. (d) To supervise the organization and directing of the health program in the plant, such as education of employees in maintenance of good health, especially in nutrition and sane habits. This includes strict supervision and uncompromising demand for cleanliness of in-plant feeding facility and food supplies. (e) Compiling and, once compiled, studying personal illness records and accident records, particularly in accident prone individuals. (f) Interpretation of repeated air analysis graphs to determine efficiency of ventilation equipment where occupational air-borne hazards exists. (g) To conduct compensably, treatment of injured employees during the emergency state of the injury, during convalescence, and during the rehabilitation state. (h) To conduct medical-care program for employees stricken with occupational disease. (i) Where possible, crystallizing data for research and when possible, publication of information to advance the practice of industrial medicine. (j) To maintain good public relations both in the plant and community by unprejudiced opinions and judgments, impartial interest and a keen sense of the lack of perfection.

In conclusion, the bare framework of organization can be a lifeless skeleton without the virile enthusiasm of its constituent members. Enthusiasm is contagious. If the plant physician does not have it, he cannot instill it in his colleagues.

ABSTRACTS

RELATION OF REFRACTIVE ERROR TO OPTOMETRIC TESTS. L. Manas. The Optometric Weekly. 1473-1476. October 5, 1950.

A statistical study was made of the effect of refractive error upon the (No. 15A) phoria obtained through the dissociated cross-cylinder finding at near in 768 cases.

From his data, the author concluded that the low coefficient of correlation found indicates no significant relationship between refractive error and the (No. 15A) phoria.

R. E. B.

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MILITARY DEFERMENTS NECESSARY FOR SPECIALIST TRAINING

In preparing for the full wartime mobilization which is inevitable for this country, serious study should be given to preserving an uninterrupted flow of trained specialists to serve both the military and our civilian economy in the years ahead.

At present, among our many priceless assets are trained scientists, educators, health workers and other specialists who have the know-how to plan and carry out large scale scientific and health programs which would be impossible without their skill. Programs that are necessary if we are to overcome the forces now marshalled against us.

While this pool of specialists is large, even now it is not adequate to properly staff a wartime economy. Furthermore, the pool is not in-

exhaustible. It can only remain a potent force in our economy if there is no serious interruption in the intake of undergraduate personnel to replace those who are lost through death and infirmities. These students, including undergraduate optometric students, must be trained irrespective of the emergency.

In times of crisis the suggestion is bound to occur that all young physically fit male citizens, irrespective of aptitudes or abilities should serve in the military forces. At first glance this proposal for universal military service seems most fair as it unquestionably treats everyone alike and squares with American principles of fair play.

The program of universal military service, however, has the major drawback of adversely affecting all citizens both in and out of the military, as it would retard the normal progress of scientific development of the country by interrupting the flow of technically trained graduates so necessary to our economy. In a protracted period of emergency such interruption might prove disastrous.

For something more than two years this very question has been before the scientific advisory committee of our Selective Service System. The committee, composed of leading educators as well as representatives of the healing arts, has considered many proposals and compiled much data relating to this subject. Every avenue has been explored and after many conferences the committee has recommended that student deferments be permitted under prescribed and limited circumstances. These recommendations, if adopted, would provide an uninterrupted annual graduate group of 70,000 specialists in all fields of science and health including optometry. These recommendations are now in the hands of General Hershey of Selective Service and will in all probability be presented to the new Congress.

These recommendations overcome the major disadvantage of universal military service. They provide the necessary flow of trained personnel to staff all phases of our economy, both civil and military, in the uncertain years ahead. Optometric organizations should support, in the fullest degree, the suggestions offered by the scientific advisory committee of Selective Service to keep the minimum required flow of undergraduate optometric students moving through our colleges and schools. And in a larger and even more important sense these proposals deserve nationwide support, as they insure a continuation of the scientific progress so necessary to our continued welfare.

CAREL C. KOCH.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

REPORT OF ANNUAL MEETING OF ACADEMY

Chicago, Illinois, December 16-19, 1950

The 29th annual meeting of the Academy is now history, and the 178 members who attended will remember it not only as a highly successful convention, but one with an overtone of seriousness caused by the critical international situation. President Truman's proclamation of a national emergency the night before registration, reminded many Fellows of the December, 1941, meeting in Chicago when the program was interrupted with the announcement of the Pearl Harbor bombing. And, as in 1941, members kept in mind the possibility that travel might be banned by December, 1951, and made every effort to foresee and resolve Academy problems that might crop up in the months ahead. Historic and progressive actions resulted which should materially aid in the continued growth and strength of the profession.

DR. HAROLD SIMMERMAN ELECTED PRESIDENT

Dr. Harold Simmerman, Woodbury, New Jersey* was elected 1951 president of the Academy at the annual election December 18, in Chicago. He moves into the presidency after a two-year term as vice-president, and two prior years as chairman of the program and papers committee.

"Simmy," as he is known to a host of friends and colleagues, has chalked up an enviable record in the 20 years he has served optometry. Through clear thinking, a firm determination to be progressive, an intense interest in the welfare of the public, and an extraordinarily affable disposition, he has become widely known not only as a practicing optometrist, but as an educator, inventor, and author. And his colleagues will quickly add "friend" to the list—friend to his associates, students and to optometry.

The optometric career of Dr. Simmerman began in 1930, when he received his Doctor of Optometry degree from Pennsylvania State College of Optometry, following preliminary education at Woodbury High School, Western Maryland College and Temple University. After a clinical internship at Pennsylvania State College of Optometry, he established a practice in Woodbury, and has devoted a major portion of

*See Frontispiece,—p. 2.

his time to it ever since. In addition to his practice, Dr. Simmerman teaches at Pennsylvania State College of Optometry and is active in numerous civic and optometric affairs in his community and state. His broad interests are evident in the list of offices he now holds, or has held: Vice president of the American Academy of Optometry; past president of the New Jersey Chapter of the American Academy of Optometry; past president of Southern New Jersey Optometric Society; past president of New Jersey Optometric Association; president, New Jersey State Board of Examiners; vice president, Gloucester County Board of School Boards; member, Mantua Township Board of Education; chairman, Gloucester County division, New Jersey Educational Planning Commission; past president, Gloucester County Camera Club; president, Bethel Lake Fishing Club.

Under the "inventor" title, comes both a hobby and vocation for Dr. Simmerman. His major avocation of photography led him to design a camera which will film the eye, and with this camera he has built up a library of slides used in teaching neural and ocular anatomy at Pennsylvania State College of Optometry. He is the school's scientific photographer and faculty advisor to the "Click Club" which devotes its time to scientific photography. Another invention is a patented tangent screen for field studies.

At present the new Academy president "commutes" the four miles from his 7½ acre wooded farm to his Woodbury office four days a week. On Wednesdays and Thursdays he can be found teaching experimental psychology and lecturing on visual fields at Pennsylvania State College of Optometry.

Dr. Simmerman was married in 1932 to Clara Boettger of New York City, and they now have two sons, Harold Martin, 14, and Steven John, 10.

In accepting the presidency of the Academy, Dr. Simmerman praised Dr. Hummel, outgoing president, for his "high courage and high ideals," and expressed the hope that "his leadership would be as effective as Dr. Hummel's in inspiring members to greater heights in scientific achievement."

EXECUTIVE COUNCIL

The new Executive Council elected to serve the Academy during 1951 is as follows:

Dr. Harold Simmerman, Woodbury, New Jersey, president; Dr. Robert E. Bannon, Hanover, New Hampshire, vice president; Dr. Daniel G. Hummel, Cleveland, Ohio, past president; Dr. Carel C. Koch, Minneapolis, Minnesota, secretary-treasurer; Dr. Lawrence Fitch, Philadel-

phia, Pennsylvania; Dr. J. D. Perry, Jr., Winston-Salem, North Carolina; Dr. R. W. Tubesing, Richmond, Indiana, and Dr. Ralph E. Wick, Rapid City, South Dakota. Ex officio members appointed to the Council include Dr. Harold Fisher, New York, New York, chairman, editorial council; Dr. Meredith W. Morgan, Jr., Berkeley, California, chairman, papers and program committee, and Dr. Arthur P. Wheelock, Des Moines, Iowa, general chairman, committee on admittance.

DR. HENRY A. IMUS BANQUET SPEAKER

Principal speaker at the annual round table banquet was Dr. Henry A. Imus, Office of Naval Research, Washington, D. C. He discussed fundamental research in binocular vision, color vision, visual thresholds and discrimination, as well as retinal studies. His talk was illustrated with slides. A summation of this paper will appear in this Journal at a later date. Dr. Imus is a Fellow of the Academy, and a former faculty member of the Dartmouth Eye Institute. He was recently appointed a member of the newly organized National Interprofessional Committee on Eye Care.

The round table banquet was held in the glittering Gold Coast Room of the Drake Hotel. It was a memorable evening of fellowship and the paying of tribute to Academy leaders. In recognition of the two years of excellent leadership as president of the Academy, and his many, many years of devoted work for Academy ideals, Dr. Hummel (and his wife, Hildegarde) were presented with a sterling silver creamer and sugar set.

Incoming president Dr. Harold Simmerman was also honored. The New Jersey Chapter of the Academy presented him with a set of carving knives in recognition of his optometric achievements both in the Academy and in his home state. The presentation on behalf of the New Jersey chapter was made by Dr. Philip Jackman.

The three new chapters of the Academy received their charters at the banquet—the San Francisco Bay Area chapter, British Isles chapter and the Upstate New York chapter.

In accepting the charter on behalf of the British Isles, Lord Charnwood spoke briefly about the British Health Scheme, and extended an invitation to Academy Fellows to attend the International Optical Congress in London next July.

EXECUTIVE COUNCIL ACTIONS

During the sessions at Chicago, the Executive Council worked on the longest and most complex agenda in the recent history of the Academy. Growth of the Academy, the international situation and new

aspects of professionalization provided problems which kept the Council in session nearly four full days. Many highly significant actions resulted from these morning to midnight conclaves. On behalf of the Academy, the Council went on record:

★ Endorsing the recommendations of the scientific advisory committee of Selective Service as these relate to the deferment of students from military service to assure a steady flow of scientific personnel in the critical war years ahead.*

★ Recommending that the Association of Optometric Schools and Colleges make appropriate studies of present curricula and provide for rapid transference to an accelerated program of studies, if necessary, because of the full war mobilization ahead.

★ Approving the formation of a reserve officers organization composed of Academy members and others, to work for improved professional status for optometrists holding reserve commissions in the military services.

★ Resolving that steps be taken to improve the quality of optometric scientific literature published in optometric journals, and that all journals make every effort to eliminate those trade paper characteristics so prevalent in some at the present time.

★ Recommending that the American Optometric Association immediately work for an amendment to H. R. No. 6000 which would limit optometric work to its proper sphere in the Social Security program, in order to further cement optometric relations with ophthalmology, and to rectify an existing situation possibly harmful to both optometry and the public.

★ Recommending that the Academy, through an appropriate committee, study plans for short courses in the specialties (aniseikonia, orthoptics and contact lenses) to be given in cooperation with the schools in the convention city prior to annual meetings of the Academy.

★ Recommending that optometry organize to protect its members and enable them to serve effectively on the home front in a national emergency, working through local or state optometric organizations.

★ Disapproving proposed and existing legislation requiring "internship" in a private office before a graduate student is eligible for state board licensure. The Academy believes this to be only apprenticeship, not internship, and is against its incorporation into state optometric acts.

The Council also approved the formation of three new chapters: The British Isles Chapter, San Francisco Bay Area chapter, and the Upstate New York chapter. Organizational problems of the British

*See editorial in this issue.

Isles chapter were discussed by the Council in collaboration with Lord Charnwood, a London member of the Academy.

Steps were taken by the Council to set up a new lecture section on occupational optometry for future annual meetings.

ROCHESTER, NEW YORK, 1952 CONVENTION CITY

The report of the time and place committee recommending Rochester, New York, as the 1952 convention city was approved by the Academy. The invitation to meet in Rochester in December, 1952, was extended by Bausch & Lomb Optical Company officials in conjunction with their celebration of the 100th anniversary of the founding of B & L in that city.

1951 CONVENTION TO MEET IN NEW YORK CITY

New York City will be the convention center for the Academy for its 1951 meeting. The Hotel New Yorker will be convention headquarters and the dates are December 8, 9, 10 and 11, 1951.

Dr. Irving Vics, chairman of the time and place committee, reported that invitations had been received to hold the 1953 annual meeting of the Academy at Denver, Colorado; the 1954 annual meeting at Houston, Texas, and Los Angeles, California, and the 1955 annual meeting at Toronto, Ontario, Canada.

LORD CHARNWOOD ATTENDS CONVENTION

Once again, the American Academy of Optometry was honored with the presence of the Hon. Lord Charnwood, London, England, at the annual meeting. In 1948, Lord Charnwood attended the 27th annual meeting as a guest of the Academy; this year he came as a Fellow, and appeared on the program. His paper, "Some Aspects of the Psychology of Binocular Vision," will be published later this year in this Journal.

Lord Charnwood is a member of the House of Lords, a staff member of the London Refraction Hospital, and one of Britain's only aniseikonic specialists. The possessor of a most distinguished personality, he again endeared himself to Academy Fellows while in Chicago by showing a deep interest in the Academy and American optometry, as well as answering dozens of questions and speaking whenever called upon (which was often) with impressive graciousness and charm.

This was his third trip to the United States, and to the pleasure of his American friends, a more lengthy stay than previously. Following the Chicago convention, he visited Los Angeles, San Francisco, Detroit, Boston, Hanover, and New York to confer with visual specialists and speak before optometric groups.

CHAPTERS DISCUSS PROBLEMS AT SPECIAL LUNCHEON

Representatives from each of the Academy's 20 chapters, including the three newly organized ones, got together for a luncheon Tuesday to discuss mutual problems and report on the year's activities.

Actually, major problems were few, but a common and mutual one was whether chapters should require membership in the parent body. Chapters who had experimented with both systems—requiring and not requiring membership in the American Academy—reported on their experiences. The consensus was that better harmony and faster progress resulted from requiring Academy membership within a reasonable length of time after joining the chapter organization. No official action was taken on the matter by the Academy, this being a problem to be handled at the chapter level.

Dr. Lawrence Fitch, Pennsylvania State College of Optometry, arranged for and presided over the luncheon, in his capacity as chairman of the chapter committee.

PAPERS PRESENTED

An exceptional variety of topics was covered in the 1950 Academy papers presented at Chicago. The papers will be published, as usual, in this Journal during the coming months. Papers were presented by the following optometrists and educators:

Dr. Isadore Kaplan, Pennsylvania State College of Optometry, Philadelphia, Pennsylvania; Dr. Charles Hendley, College of Medicine, University of South Dakota; Dr. Mathew Alpern, School of Optometry, The Ohio State University, Columbus, Ohio; Dr. George W. Knox, also of Ohio State; Dr. S. Howard Bartley, Michigan State College, East Lansing, Michigan; Dr. George Parkins, Ord, Nebraska; Dr. John C. Neill, Pennsylvania State College of Optometry, Philadelphia, Pennsylvania; Mr. Sylvester A. Guth, General Electric Company, Nela Park, Cleveland, Ohio; Dr. Robert E. Bannon, Hanover, New Hampshire; Dr. Harold Simmerman, Pennsylvania State College of Optometry, Philadelphia, Pennsylvania; Dr. Meredith W. Morgan, Jr. and Dr. Robert Harrigan, School of Optometry, University of California; Dr. Helen M. Robinson, University of Chicago Reading Clinic, Chicago, Illinois; Hon. Lord Charnwood, London Refraction Hospital, London, England; Dr. Eugene Freeman, Chicago College of Optometry, Chicago, Illinois; Dr. William P. Schumann, Vineland, New Jersey; Dr. William G. Walton, Pennsylvania State College of Optometry, Philadelphia, Pennsylvania; Dr. Richard Feinberg, College of Optometry, Pacific University, Forest Grove, Oregon; Dr. Henry L. Wolfe, Marshalltown, Iowa; Dr. William Smith, Massachusetts College of Optometry, Boston, Massachusetts; Dr. Vincent J. Ellerbrock, School of Optometry, The Ohio State University, Columbus, Ohio; Dr. Henry W. Hofstetter, Los Angeles College of Optometry, Los Angeles, California; Dr. Harry Jankiewicz, Los Angeles College of Optometry, Los Angeles, California; Dr. Roy Marks, Bausch & Lomb Optical Company, Rochester, New York; Dr. Arthur Shlaifer, Pennsylvania State College of Optometry, Philadelphia, Pennsylvania; Dr. Thaddeus Murroughs, Chicago College of Optometry, Chicago, Illinois; Dr. I. Irving Vics, Albany, New York; Dr. Marguerite Eberl, Milwaukee, Wisconsin; Dr. R. A. Phillips, Lee, England.

SECTION MEETINGS

Sections on aniseikonia, orthoptics and contact lenses met concurrently each morning for round table discussions and lectures. The

pathology section this year was open to all, and held at 11 A. M. each day, with a scheduled speaker. In charge of the sections were Dr. Harold Fisher, New York City, aniseikonia; Dr. J. Donald Kratz, Souderton, Pennsylvania, orthoptics; Dr. John C. Neill, Philadelphia, contact lenses, and Dr. W. O. Vivian, Media, Pennsylvania, pathology.

COMMITTEE APPOINTMENTS AND OFFICERS' REPORTS

Committee appointments for 1951, and the 1950 reports of the president and the secretary-treasurer will appear in the February issue of the Journal.

CONVENTION SIDELIGHTS

Program timing for Dr. William Schumann's paper on the 100th anniversary of Helmholtz' ophthalmoscope was perfect. Dr. Schumann presented his paper on December 17, 1950; Helmholtz presented his *Augenspiegel* (eye mirror) as he called it, on December 17, 1850.

Northern Illinois College of Optometry graciously offered the use of its clinic to the Committee on Admittance in connection with entrance clinical examinations for Academy Fellowship. These examinations were held at N. I. C. O. the two days prior to the official meeting, under the supervision of Dr. Arthur P. Wheelock, general chairman, committee on admittance.

Secretary Carel C. Koch was called away from the convention Sunday evening by General Lewis Hershey to attend a special meeting of Selective Service's national healing arts advisory committee. He returned Monday evening after the annual banquet, and reported on his Washington trip at the final business meeting of the Academy Tuesday afternoon, explaining the problems facing the Government in regard to deferment and military training.

In response to a nationwide demand, Dr. Robert E. Bannon, Hanover, New Hampshire, Dr. Harold Fisher, New York, New York and Dr. Leo F. Madigan, Boston, Massachusetts, conducted a course in aniseikonia prior to the annual meeting. The course was not sponsored by the Academy, but held concurrently with the annual meeting. The Chicago College of Optometry provided clinic space to hold the aniseikonic instruction. Used in the instruction was the new pilot model space eikonometer recently introduced by the American Optical Company. AO Company lent the instrument to the instructors especially for the course. The new space eikonometer, a very small and compact instrument, may now be ordered from the American Optical Company, which hopes to produce it in sufficient quantity to take care of the many known and suspected cases of aniseikonia in this country.

NEW MEMBERS OF THE ACADEMY

The following optometrists and educators were elected to Fellowship in the American Academy of Optometry during the quarter ending December 31, 1950. The Academy welcomes these new members.

Dr. Margaret J. Anderson, Los Angeles College of Optometry, 950 West Jefferson Boulevard, Los Angeles, California.

Dr. Agnes Sutton Austin, 2707 Biscayne Boulevard, Miami, Florida.

Dr. Solon M. Braff, 1574 Crossroads of the World, Hollywood, California.

Dr. J. C. Carpenter, 210 Howard Building, Moberly, Missouri.

Dr. John Townsend Collins, Lewisburg, West Virginia.

Dr. Paul L. Connolly, 701-702 Washington Boulevard Building, Detroit, Michigan.

Dr. J. Lawrence Ebauer, 926 Light Street, Baltimore, Maryland.

Dr. Earl L. Ferris, Room 300, 16 North Marengo Avenue, Pasadena, California.

Dr. Edward I. Goodlaw, 808 Haas Building, Los Angeles, California.

Dr. Robert H. Harrigan, School of Optometry, University of California, Berkeley, California.

Dr. Robert A. Hass, Connor Building, Owosso, Michigan.

Dr. Alfred C. Haughton, 207 Harvey Building, West Palm Beach, Florida.

Dr. Frederick W. Hebbard, School of Optometry, University of California, Berkeley, California.

Dr. Don Hines, 1114 Main Street, Sturgis, South Dakota.

Dr. Ned P. Hobbs, 119 Cashua Street, Darlington, South Carolina.

Dr. Louis Jaques, 828 Pacific Mutual Building, Los Angeles, California.

Dr. George N. Jesson, 59 E. Madison, Chicago, Illinois.

Dr. John R. Kennedy, 424 Hamm Building, St. Paul, Minnesota.

Dr. Alfred L. Klein, First National Bank Building, Spirit Lake, Iowa.

Dr. Frederick Kushner, 7523 South Stony Island Avenue, Chicago, Illinois.

Dr. W. H. Landon, R. O., 1555 Danforth Avenue, Toronto, Ontario, Canada.

Dr. Walwyn S. Long, R. O., Ontario College of Optometry, 140 St. George Street, Toronto, Ontario, Canada.

Dr. James F. Loomis, 303 Masonic Temple Building, Jacksonville, Florida.

Dr. J. B. Meloan, Bushnell, Illinois.

Dr. Leo Meyer, 115-M New York Building, St. Paul, Minnesota.

Dr. Roy E. Meyers, 208 East State Street, Columbus, Ohio.

Dr. Homer A. Nelson, 114 N. Lemon Street, Anaheim, California.

Dr. Henry B. Peters, 2611 Telegraph Avenue, Oakland, California.

Dr. R. C. Phillips, 909 Third Avenue, New Brighton, Pennsylvania.

Dr. Jack A. Potter, 1232 Jefferson Building, Peoria, Illinois.

1st Lt. Alvin E. Reynolds, MSC, Letterman Army Hospital, San Francisco, California.

Dr. Kenneth G. Robinson, 105 North Court Street, Medina, Ohio.

Dr. S. B. Schumacher, Professional Building, Jacksonville, Florida.

Mr. R. A. Sherman, Occupational Vision Department, Bausch & Lomb Optical Company, Rochester, New York.

Dr. Benjamin Sobel, 711 Main Street, Clifton, New Jersey.

Dr. Grace Stevesson, 11131 South Michigan Avenue, Chicago, Illinois.

Dr. Bernard E. Vodnoy, 215 Poledor Building, South Bend, Indiana.

Dr. Newton K. Wesley, 59 East Madison Street, Chicago, Illinois.

Dr. H. S. Wodis, Chicago College of Optometry, 1849 Larrabee Street, Chicago 14, Illinois.

CURRENT COMMENTS

Virginia Huck
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department: such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

CONTINUED PROGRESS IN 1951

As far as the world was concerned, 1950 was neither a pleasant nor a peaceful year, as we had hoped. But it can be said truthfully that 1950 was a good year for optometry. The turn of the half-century saw the culmination of many worked-for objectives, and progress on others. We hope 1951 is as fruitful. The accomplishments of 1950 have created new problems for 1951—problems that will perhaps take more time and effort than ever to work out. As the New Year gets under way, we offer our wish for wise decisions and continued progress by the profession.

This month we wind up the news for 1950—we always wish we

could print all we receive each month, but space is limited. We wish to thank those who have sent in scientific news, and urge others who have not, to do so during 1951.

MORE ON "PHYSICS TODAY"

We believe our readers, as scientists, educators and practitioners, are interested in the progress of all allied scientific fields. If we are right, then you will be interested in doing what you can to give a lift to an outstanding scientific journal which, it might be said, is suffering from the normal "growing pains" of a new publication.

We are speaking of *Physics Today*, one of the finest journals to come into the scientific field in the past few years. At the present time, *Physics Today* is passing through a crucial financial period, and is appealing to interested persons to take an interest in its future welfare. In the November, 1950, issue, its editors point out that the future of *Physics Today* depends upon the interest and effort of many people—more subscriptions and more advertising are needed to help the magazine achieve its dedicated purpose of advancing physics and its applications to human welfare.

Physics Today, in its short life of two and one-half years, has achieved high standing and won several awards. In 1948, shortly after its debut in May, the journal won two awards of merit in the *Industrial Marketing Magazine's* annual editorial achievement competition; in 1949, *Physics Today* was awarded first prize in this same competition for graphic presentation and an award of merit for an outstanding single article. Many magazines have found its material worthy of reprint.

All of which means you can feel justified in giving *Physics Today* a boost by subscribing, or reminding interested friends to subscribe. It is worthy of all support that can be given it by optometry. The address is American Institute of Physics, 57 East 55th Street, New York, 22, New York; the subscription fee $4.00 in the United States, its possessions, Canada and Mexico; elsewhere $5.00.

RESEARCH AND NEW INSTRUMENTS

The American Optical Company is now working to fill orders for its new space eikonometer brought out only a few weeks ago. The new instrument is smaller in size than previous instruments, and simplifies the detection and measurement of aniseikonia through its self-contained lens system and aniseikonia-revealing test patterns. With this eikonometer the trained examiner can measure horizontal, vertical and oblique differences in the size and shape of the ocular images, thus permitting

him to determine a prescription for the necessary corrective lenses.

The pilot model of the new eikonometer was used recently for a special course in aniseikonia in Chicago conducted by Dr. Robert E. Bannon, Hanover, New Hampshire; Dr. Harold Fisher, Mt. Kisco, New York, and Dr. Leo Madigan, Boston, Massachusetts.

To date, only about 50 instruments have been available for measuring aniseikonia, and these were primarily for use by aniseikonic specialists. AO Company expects to produce the new model in sufficient quantity so vision specialists in general will be able to test for the anomaly, after suitable periods of graduate training.

A new, specialized form of Soft-Lite glass has been perfected after many years of research. The new glass was made especially for hardening (safety) purposes, and has all the neutral absorption properties of regular Soft-Lite glass. The product was developed by the Bausch & Lomb Research Bureau at Rochester, New York.

A new instrument for distance retinoscopy has been brought out in England—the Phillips Reflectoscope. According to the October 13 issue of the *Optician*, this instrument was designed to enable retinoscopy to be performed along the visual axes of the patient, and to permit the investigation of the refractive condition by retinoscopy while the patient has good acuity in binocular vision.

B. V. I. CHANGES DUES

Inflation has finally caught up with the Better Vision Institute. Reluctantly, and only because of inflationary conditions, B. V. I. has raised its dues for all classes of professional members. This is the first increase in its 20-year history. The new fee is $5.00 a person, with a minimum of $10.00 for each establishment. This means that now all one and two-member offices and establishments pay $10.00 annually; three-member offices $15.00, etc. The decision to increase professional dues was made by the board of directors comprised of optometrists, opticians, supply houses and manufacturers, after long deliberation.

The Journal hopes this increase on the part of B. V. I. will in no way hamper the necessary and excellent job it is doing for the profession. In the critical months ahead, the programs sponsored by the Institute will be needed more than ever. Public misconceptions and prejudices are not yet overcome, and in this field alone, B. V. I. performs invaluable work for the profession by combating them.

NEWS BRIEFS

The Minnesota State Optometric Association has joined the list of groups who have organized civilian defense committees for protec-

tion of the public and practitioners in period of emergency. Dr. Roger Lindquist, Minneapolis, is chairman. . . . Dr. William L. Benedict, Mayo Clinic, Rochester, Minnesota, received the Leslie Dana Medal for 1950, a national award for outstanding achievement in preventing blindness. The award announcement was made by Dr. Franklin M. Foote, executive director of the National Society for the Prevention of Blindness. Personal presentation will take place January 26 in St. Louis concurrent with the St. Louis Ophthalmic Society meeting. . . . Milestones: The American Board of Opticianry enters its fifth year with 1951. Through its work during the past four years, three accredited educational institutions now offer two-year courses in opticianry, and nearly 500 leading opticians from the United States and Canada have qualified for certification by the Board. The December, 1950, issue of Continental Optical Company's *Continental Digest* marked its 35th year of publication, first as the *Ultex Hatchet*, then *Ultex Magazine*, next to *The Continental Magazine*, and in 1939, the *Continental Digest*. Nearly 30,000 optometrists and optical men are on its current mailing list. . . . American Optical Company has purchased the Wottring Instrument Company, Columbus, Ohio. . . . Television props for the mystery, "The Plain Clothesman," recently produced in the East, were furnished by Soft-Lite Lens Company. Bay State Optical Company and Bausch & Lomb's Northeast Division. . . . New straight top bifocals are now being produced by Titmus Optical Company, which describes them as having "superior segment definition." . . . Dedication ceremonies for the Horace Mann building, recent addition to Massachusetts College of Optometry, took place January 4. . . . Southern College of Optometry conferred Doctor of Optometry degrees on 53 candidates at its December commencement. . . . An alumni association has now been organized by Chicago College of Optometry. . . . Building plans for a new campus and college plant for Southern College of Optometry are moving toward the blueprint stage, with the appointment of an architect to plan a new clinic, laboratory, classroom and office space, a student lounge and library. Cost: an estimated quarter of a million dollars. . . . The complete volumes (12 issues) No. 26 for 1949 and No. 27 for 1950 of the *American Journal of Optometry* are now available on 35 mm. film, from University Microfilms, 313 North First Street, Ann Arbor, Michigan. Cost per volume on film is $2.20 each. . . . The annual meeting of the National Society for the Prevention of Blindness will be held March 26-28, at the Hotel New Yorker, New York City.

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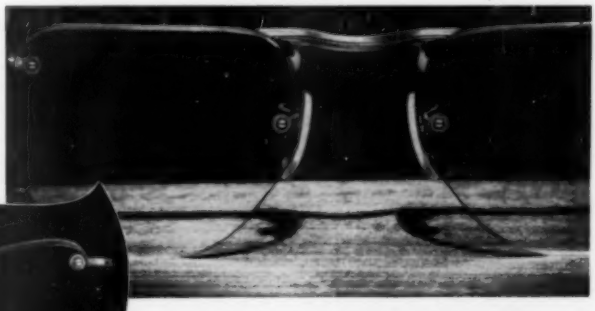

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